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Molded Plastics and Their Manufacture

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The advent of quick-curing compounds has led to the development of a number of highly-efficient presses for mass production

SINCE the advent of the newer molding compounds of the past twenty years, a marked development has been made in the equipment available for the working of molded plastic materials. This improvement has centered largely around molds and presses. It has been brought about chiefly because of the quick-curing materials placed on the market, with the possibilities they offer for the mass production of innumerable industrial parts and products.

In Fig. 10 is illustrated a type of simple press upon which the molding industry depended for years, and still uses to some extent. The press shown is known as a plain heating press, and, used in conjunction with hand molds, it makes a very satisfactory unit for small jobbing, where production does not warrant the expense of an improved type of press, or multi-cavity mold. In molding plastics requiring chilling, a chilling press of the same type would be placed near the heating press, so that the operator could shift the mold conveniently from the hot to the cold press. In a typical hand-molding plant, the operator works at the hot press, with a worktable or bench at his back and a preheating plate at his right. The chilling press may be placed at his left, or if a stripping press is used for opening the molds, this may be placed at the left, and the chilling press mounted beside the hot press, in front of the operator. The steam economy is very good in a unit of this type, since only the mold is heated and chilled during the cycle. Although a single press can be used to do the same work, by alternately heating and chilling the steam plates, the steam and water consumption not only is considerably increased, but even more important, the time cycle is prolonged, reducing production.

Hand-molding units are frequently installed with a hand-pump attached to each press, as in Fig. 10, in which case the cost of a central high-pressure water system is saved. Where overtime work may be necessary on only a few units in an entire plant, such an arrangement offers a considerable operating economy. Where city pressure is high enough (about 75 lb. minimum) it is generally found advisable to run the platen up with this low pressure water, using the hand pump for the final closing pressure. If cost of new water is prohibitive, a high-and-low-pressure hand pump may be used to advantage. In this pump, a relatively large piston may be used for stroking up the platen at fair speed, after which this piston is locked and the stroke completed with a smaller plunger capable of delivering the required high pressure. This arrangement wastes no water whatever, since the ram, in descending, forces the press water back to the hand-pump reservoir, where it may be used indefinitely.

In Fig. 11 is shown the same plain type of press as Fig. 10, but serviced by a motor-driven high-and-low-pressure pump, which has a reservoir in the base, and a small pressure-weighted accumulator integral, at the back. This unit also offers advantages in partial-plant operation, and when equipped with electric or gas heater plates, is truly an independent and self-contained unit.

The foregoing figures illustrate a "rodless" type of plain press, in which the rods, or stanchions, are cast with the head and cylinder, making a more compact machine than the common four-rod press. Height of

Selection of presses for most economical production is an important element in the manufacture of molded products. Design of products, volume of output, hydraulic equipment required, and the heating medium, all enter the problem

The third and last article of a series.

Fig. 10 — A plain heating press, with hand pump for hydraulic operation of the platen, makes a very satisfactory unit for small jobbing work

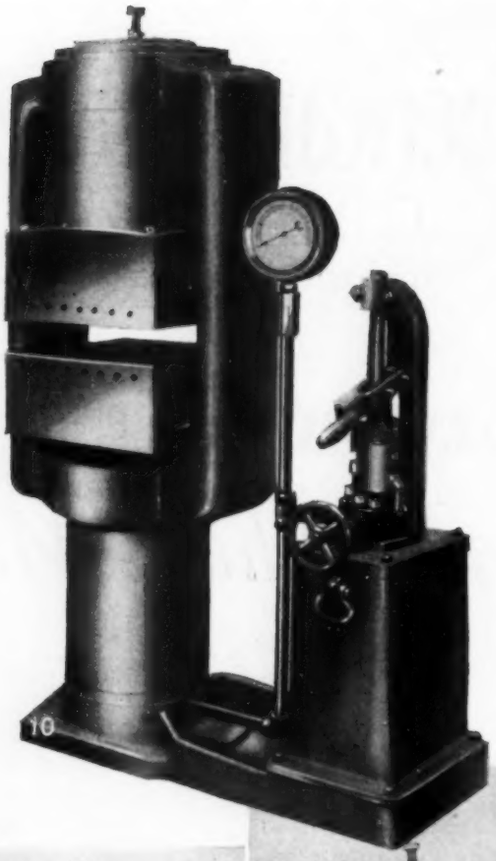
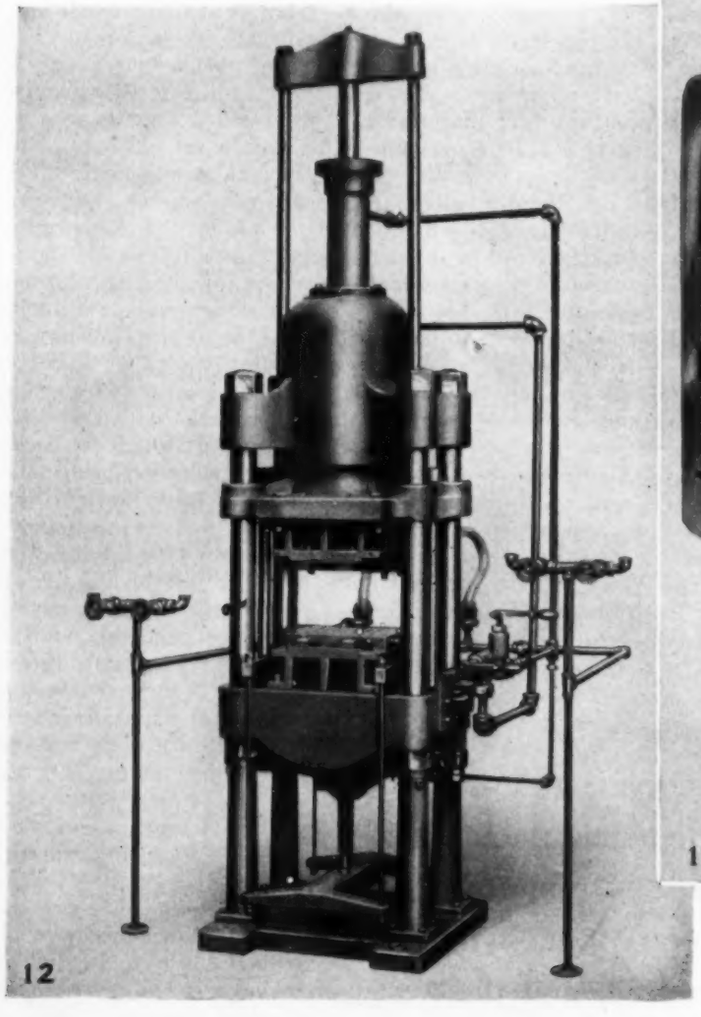
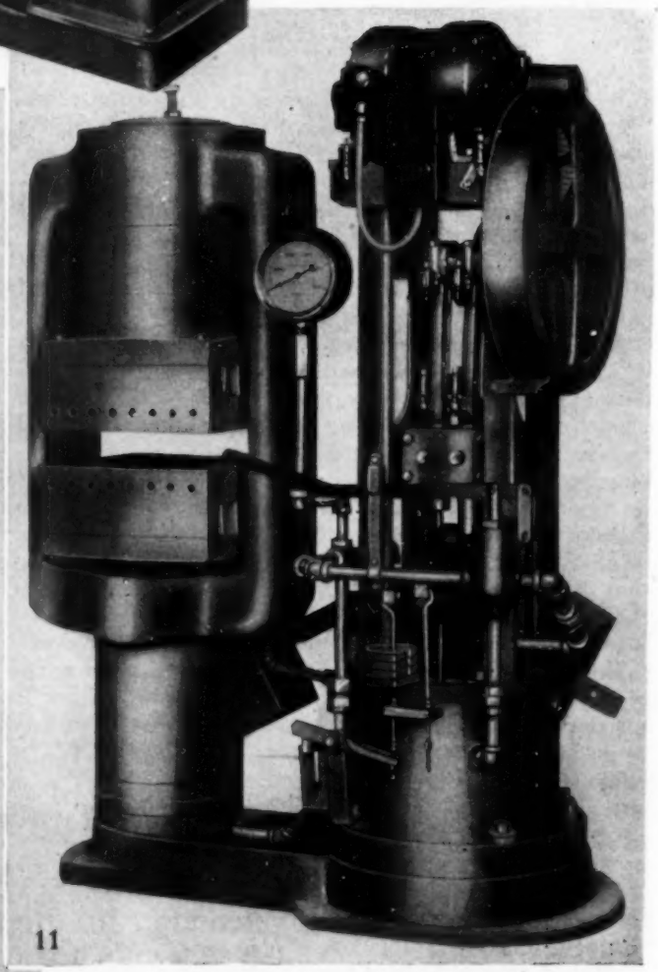


Fig. 11—The plain heating press is sometimes equipped with a motor-driven high- and low-pressure pump, with reservoir in the base and weighted accumulator at the back

Fig. 12 — Semi-automatic presses are used for large production. They have pull-back cylinders, opposed to the main ram to return it to its initial position. Work is automatically ejected by pins arranged to strike fixed stops just before the end of the opening stroke





Photographs courtesy the Burroughs Company

opening is regulated by inserting spacing rings under the head, alignment of platens being automatic, as contrasted with a rod-press in which the platens must be accurately paralleled whenever the rod-nuts become loose.

In either case, the most useful size of press for the hand-molding shop appears to be a machine with 18x16-in. platens. This press has, most often, an 8-in. diameter ram, giving a total power of 75 tons at 3,000 lb. per sq.in. operating pressure. Advantage cannot be taken of larger platens than this, since the hand molds become too cumbersome to handle.

Since in a plain press the ram returns merely by its own weight after the pressure is released, this type of press is not at all suited to automatic ejection of the work from the mold, as the force required is sometimes considerable. Automatic ejection, and increased production demands brought about improved types of molds, and the type of press shown in Fig. 12.

This semi-automatic press is distinct from the plain type in having a relatively small "pullback" cylinder, opposed to the main ram, and connected to the line pressure at all times. Thus, when the pressure is released in the main cylinder, the pullback will return the ram to the initial position. In the moving half of the mold, ejector pins are arranged to strike fixed stops, just before the end of the opening stroke, while the pullback continues to move the platen to the end of the stroke raising the ejector pins in the mold and ejecting the work. Where ejection in the fixed half of the mold is desired, this may be easily accomplished by taking the motion from the moving platen, by rods, to an ejector frame under the pins in the fixed part of the mold. The rods, not rigidly attached to the moving platen, pick up the motion only at the end of the opening stroke, raising the pins the amount which the platen continues to move. While the semi-automatic press in small sizes is commonly built with the main and pullback cylinder at the bottom, the larger and more useful sizes would thus need a pit. To eliminate this requirement, they are built with the ram above, and are thus often called "inverted ram presses."

The illustration shows a typical four-rod press, such as finds great favor in production molding. As an improvement on this, and only lately introduced, is a rodless type which offers some distinct advantages. In this type the ejector pins are operated by hydraulic ejector cylinders, one for each half of the mold, and independently operated. Also, provision is made for attaching special devices such as horizontal cylinders, for pulling horizontal mold pins from any or all sides. In addition, the main and pullback cylinders are actually plain cylinders, which may be removed in a few minutes and replaced by others to suit the line pressure, or new mold-pressure. A single adjustable ejector frame eliminates the special frame ordinarily required for each new mold.

Semi-automatic presses are essentially production machines, since the size of mold is limited only by the size of press, and there is no handling of the mold. The mold, being fixed in the press, has a much greater length of life than a corresponding hand-mold, due to absence of battering by the operator, and straight-line opening and closing. Also, the mold, whenever practical, is made direct-heated, eliminating the alternate heating and chilling of steam plates. However, due to better condition of the contact surfaces, even the indirect-heated type of mold will heat and chill faster than a corresponding hand mold.

The commonest steam-connection to the moving platen is made by means of swing-joints. Flexible tubing finds considerable use, and, to a lesser degree, soft copper tubing and packed slip-joints.

The next type of press introduced was the "tilting-head" press, shown in open position in Fig. 13. This press was developed to meet the demand for a machine in which the operator could set upper mold-inserts, without "standing on his head," and easily inspect and clean the upper half-mold. The press shown accomplishes these purposes by the use of movable side rods, hydraulically operated, which swing back after the platen has dropped. Trunnions on the upper platen allow it to be swung into a vertical plane, by operating side-rods, and the head moves back only to the rear edge of the lower die, providing clear space in which to work. As only a short stroke is required before the head may be tilted, this press operates with comparatively little water. The platens are relatively narrow from front to back, for the convenience of the operator in loading. This same general shape is the tendency in all large molding presses, as an aid to production. A hydraulically-operated steam-and-water valve is mounted at the left, the press being operated entirely by the hydraulic valve located at the operator's right. Automatic ejection is obtained by use of four pull-backs on the lower platen. In the larger sizes, a hydraulic ejector-cylinder is used.

Although several sizes of this press are available, the

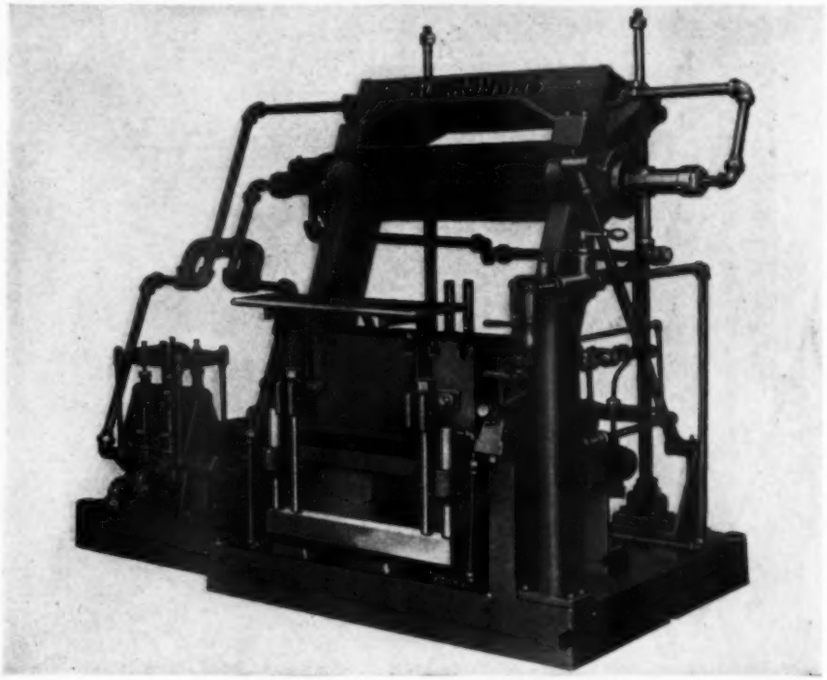


Fig. 13 — Tilting-head presses have been developed to throw back the upper half-mold for convenient placing of inserts and easy inspection and cleaning. As many as 100 impressions per mold can be made in such presses

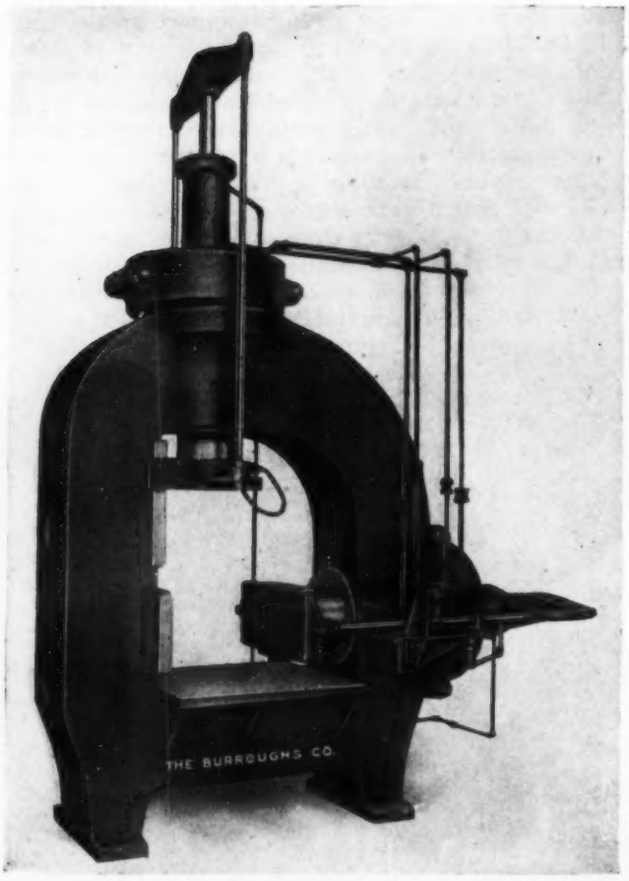


Fig. 14 — The angle-mold press accommodates parts which could not be ejected from a two-piece mold, owing to undercuts. Pullbacks are installed on both rams so that ejector pins may be used in any part of the mold, although one part is frequently a core and its withdrawal permits ejection of the product by means of the ejector pins in the other part

75-ton in this type, as well as in the semi-automatic previously mentioned, seems to be preferred for general production molding. As an example of the production possible with a modern molding press, one tilting-head press of the type shown, but heavier tonnage, is turning out 10,000 pieces per 8-hr. day. The pieces are about 1⅜ in. in diameter, and the time cycle is about 2½ min. While this particular mold had in the neighborhood of 50 impressions, the number of impressions per mold may run as high as 100, depending upon production requirements.

A special-purpose press is represented in Fig. 14, known as an "angle-molding" press. This press was developed for accommodating split molds used for parts which could not be ejected from a two-piece mold, owing to undercuts. Since it has pullbacks on both rams, ejector pins may be used in any part of the mold, although one part of the mold is frequently a core, which, upon being withdrawn, will permit satisfactory ejection with pins in merely one part of the split die. While split molds are occasionally made as hand molds, with the split dies held together by a chase-ring during the molding operation, these require a great deal more handling than the ordinary hand mold, while the corresponding mold in an angle-molding press, requires no handling, and, in addition, can usually be made direct-heated. These presses are made in several sizes, and in both the rod and rodless types, as desired. One of the latter is shown in the illustration, having a force of 150 tons on each ram.

In conjunction with the foregoing molding presses, it is usually found advisable to provide a number of preforming, or tableting machines, when the molding material is of a loose, bulky nature. Occasionally, hydraulic presses are used for this work, being suited to the production of large, but relatively few tablets. The customary installation, however, consists of a mechanically-operated press, such as shown in Fig. 15, where the production demands are great, and the tablets relatively small. Presses of this type, originally designed as pill machines, have proved very satisfactory for the tableting of plastics. While the machine shown has a capacity of only 60 1½-in. diam. tablets per min., larger rotary types of presses capable of producing 500 1½-in. tablets per min. are also available, and as many as 1,500 tablets per min. may be produced in small sizes. The power required for operating these machines is very small, usually 2 to 5 hp. The latest improvement in production has been the adoption, in many cases, of a spherical tablet, rather than the usual disk form, since the former may be fed by gravity to the work.

Central Hydraulic System Usual Practice

While some few hand-holding plants depend upon individual hand-pumps for operating the presses, the commonest layout consists of a central hydraulic system, distributing to the individual presses. The high-pressure water is furnished by a displacement pump of two, four, or six plungers in either the horizontal or vertical types, and motor- or belt-driven. As a reservoir for high-pressure water which may be suddenly drawn faster than the pump could momentarily supply it, an accumulator is a necessity, in conjunction with the high-pressure pump. The accumulator consists of a loaded plunger fitting a relatively long and slender cylinder. The pump forces the plunger vertically to a height at which a trip, actuating the pump, permits it to run idle. When a volume of water equal to that in the accumulator cylinder has been used, the descending plunger, operating a second trip, throws the pump again into action.

The usual type of weighted accumulator, with its customary enormous ballast of cast iron, is more frequently being omitted in favor of the pneumatic type, where new equipment is being selected. In this latter type, compressed air, acting on a relatively large piston, transmits its pressure directly to the accumulator plunger, which, being of a smaller diameter, intensifies the pressure per square inch which it imparts to the confined water. This accumulator is especially desirable for location on an upper floor where the weight of the other type would be prohibitive. While it gives varying pressure, due to the expansion of the compressed air, this variation is generally of no consequence, and, at any rate, may be reduced by any desired amount by selection of a larger air tank.

The foregoing hydraulic system is sometimes found expensive to operate, since high-pressure water is used during the entire stroke of the ram, although needed only for the final closing of the mold. If city-supply water could be obtained cheaply enough it would offer a remedy, where the pressure is sufficient, but this generally proves more expensive than the high-pressure system alone. However, an economical high-and-low-pressure system may be used, in which the low pressure is furnished by a separate pump. Three- and four-stage centrifugal pumps are very satisfactory for this service,

and, by use of a reservoir, the system can be made independent of outside supply, except for "make-up" water to care for leakage.

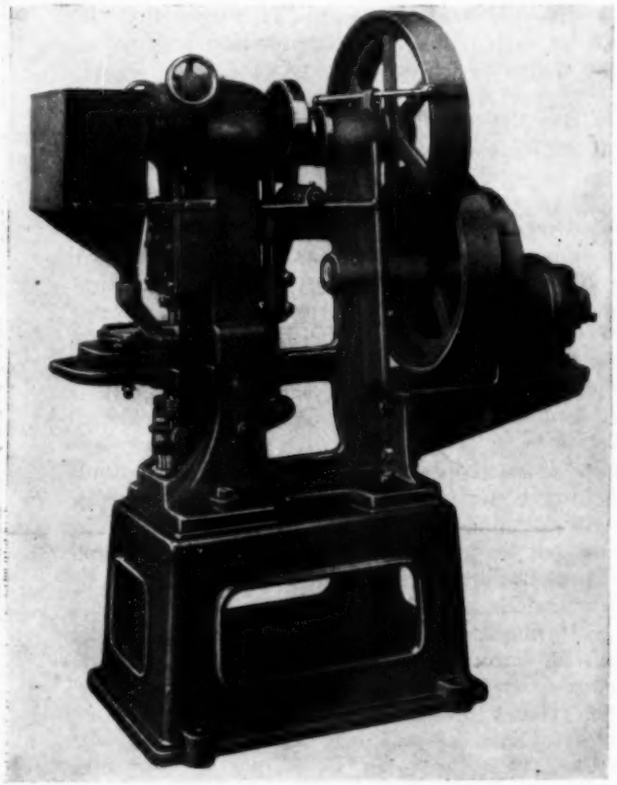
A high-and-low-pressure system offers an operating advantage in using molds having slender, horizontal mold pins. These pins may be easily bent, where high pressure is directly applied to close the mold, while, in closing under low pressure, the material has a chance to become plastic and flow around the pins, doing no damage when the high pressure is finally applied.

Line pressures are not at all standardized at the present time, since many old installations are still operating at 1,500, 2,000, and 2,500 lb. per sq.in. and various intermediate pressures. The tendency, however, has been to operate at higher pressure, with the result that the common line pressure in new plants is 3,000 lb. per sq.in. This has been made possible chiefly by better packings, valves and fittings. There appears to be no general tendency to use a still higher line pressure at the present time.

Hand-operated valves for presses, while improved in material and design, remain essentially needle-valves, this type having long since proved to be the most satisfactory type for high-pressure work. Automatic valves are now available, which can be used to control the entire operation of the press. The timing device incorporated, is very flexible in adjustment, to allow variation in the events of the cycle, as needed for different molds.

Owing to its peculiar properties, steam offers the most stable heating medium for molding. Approximately 80 per cent of the heat content of steam is represented by the heat of vaporization, all of which may be given up at a given pressure, with no drop in temperature, although the steam will condense. The noticeable drop in platen temperature, occurring when a cold mold is placed between gas- or electrically-heated plates, is either negligible, or entirely absent, with steam. Gas or electricity requires careful control at the individual press, while the steam boiler, seldom allowed to vary more than a few pounds, provides adequate control at the source.

Present-day tendencies in the molding industry are, more than ever, toward higher production. Probably the greatest single contribution has been in the reduction of the curing time of the newer compounds. As an example, one compound has had the curing time reduced to 25 per cent of what it was only ten years ago, and at the same time the cost has been proportionately reduced. The equipment manufacturer has responded with mounting of molds in the press, and providing positive ejection of work, thus saving handling time. Further time has been saved in making molds direct-heated when possible, and in making larger molds economically practical through the development of the hobbing process of duplicating mold impressions. Preforming, or tableting of otherwise loose molding material, has also been a great aid in saving time and reducing mold cost, by allowing quicker handling and shallower molds. Inserts are no longer popular with the molder, and where a subsequent machine operation will allow omission of an insert, the tendency is to omit it, as a matter of saving the time of setting in the mold. The demand for faster-moving equipment, sometimes heard, is misapplied, but can conveniently be met at any time merely by increasing size of pump and supply pipes.



Photograph courtesy of F. E. Stokes Machine Co.

Fig. 15 — Tableting, or preforming machines are used when products are to be made in large quantities from molding material of a loose, bulky nature. The material is compressed into a spherical, or disk, form and in this shape is much more convenient to use in the molding presses. Tableting machines are usually mechanically driven, although some are hydraulically operated

The Best Defense Against Communists
Discussion

By H. James
Birmingham, England

IN THE editorial on page 564, Vol. 70, of the *American Machinist* under the above title it is recommended that foremen bring to the notice of the management causes of discontent revealed through the activities of agitators before the trouble comes to a head. To my mind the best preventative of strikes is ample provision for the ventilation of grievances. If any incipient cause of discontent is brought to light by a grumble almost as soon as it arises, measures can be adopted to put things right before trouble occurs. If the grievances, whether real or imaginary, that the agitator brings to the attention of the workers can be discussed with the management in the open, his ammunition will be useless. It is only when the more plausable arguments are given color by the management refusing to discuss them that the ground is rendered fertile for the less plausible but more dangerous ones.

To get rid of the agitator before he is discredited in the eyes of the workers generally is useless. He can so easily be made to appear a martyr in the cause of progress, and his arguments are given thereby added emphasis. While an agitator is not altogether to be welcomed, yet careful handling when he does appear will reflect credit on the management and give the workers greater confidence in the fairness of their employers. If he is a good worker it may be well to retain him.

What is Modernization ?

THERE was a meeting at the Blower Company's plant and Bill Holland had been specially invited to sit in.

"I'm up against it, Holland," said Bob Winters, the manager. My directors have the 'modernization' bug and think I'm an old fogy because I don't turn the shop upside down every so often. Just what is this modernization thing anyhow, Bill?"

"That depends on who is talking to you, Bob. If it's a machinery salesman, he probably thinks that you should throw out all your old machine equipment and buy new. If it's an efficiency engineer he is equally sure that your whole system is bad, and that you need his particular brand of efficiency—and so on down the list."

"Then you think it's a lot of bunk, eh, Bill?"

"Not on your life, Bob. It's a real problem, and when you get to thinking that everything is O. K. you're headed for the rocks. But I'd like to hear Billings tell us what he thinks modernization means in the machine department."

"I ought to have a few new machines, Mr. Winters," said Billings, "and I'd like to have some of these new cutting tools. There are a few machines it will pay to spend some money on, too. A little modernizing will make them O. K. for our work."

"And how would you modernize, Carter?"

"I'd begin by having some of our products redesigned, Mr. Holland. Some of the parts could be changed so as to be easier to machine, and to be switched on some of our machines that are more efficient than those we have to use now. Then I could shift some of the machines for a different sequence of operations and make a more continuous flow of work. I'd also like to put in a few roller conveyors and some power lift trucks and a lot more truck platforms."

"It seems to me," spoke up Holland, "that you've got a pretty good modernization program all laid out, Bob. Both Billings and Carter have given you some good suggestions that are worth looking into."

"But they all cost money, Bill. Might as well ask me to build a new shop. The directors won't stand for it. They want improvements that don't cost anything."

"That's what they'll get, Bob, if these suggestions are good. Any change costs money while you are making it, even shifting a machine from one place to another. But it's an investment that pays dividends if the move is wise. It's the same with the suggestions you've had.

"They sound mighty reasonable to me, too, especially the redesigning of some of the machine parts. We get into the habit of thinking that designs are final when they can frequently be modernized as well as the method or the machine that makes them. Sometimes we save money by making a piece in two parts or by combining two in one. Then too, we mustn't forget that the welder is playing a part in modern production, and saving money in many places."

"But the directors don't want to spend any money to speak of, Bill," said Winters.

"Just ask them, Bob, how they expect to get dividends until they buy the bonds that earn them. You better get both Billings and Carter to give you an estimate on the cost of the money they want to *invest*—don't say spend—and the savings they expect from it. If the figures don't get you the money, there's something wrong with either the directors or the figures. Their suggestions seem to answer your question as to what modernization is.

"As I understand modernization, it means getting better results from our plants either by new machines or by improving old ones, by changes in design or methods, or in any other way that shows a net saving."

"It might be easier, Bill, if there was some special formula we could take like a patent medicine. But I'll put it up to the directors and see if they'll come across with the cash."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

EXECUTIVE FORUM

Discussion

Cash or Royalty on Machines

If Joe Thompson had taken the initiative in designing a new machine, and then offered it to Mr. Baker, it would have been quite proper for the latter to suggest payment on a royalty basis. In that case, Baker would have been in the position of negotiating for something already designed, and putting it to use on a trial basis. If his bid was not acceptable, the designer, was under no obligation to take it. The "gamble" on the design would have been definitely taken by Joe Thompson, on his own initiative.

But in the case under discussion, the machine has been designed to order. Joe Thompson was not taking the initiative on the utility of such a machine. That factor was up to the Baker Machine Company. The designer's responsibility was the meeting of the specifications laid down for such a machine, which he not only did, but exceeded. Therefore he was entitled to payment in full.

Baker would probably have resented an investigation on the designer's part as to whether the company had sufficient need for such a machine to warrant its design. Yet the suggesting of royalties as payment after the job had been done, would force the designer to depend for his compensation on factors over which he has no direct control and of which he was not even in a position to judge in advance. Of course, any mutually satisfactory arrangement is a solution, but in lieu of this, cash should be the accepted means of payment. —WILLIAM W. DAY.

Rules—and When to Break Them

It is a widely-held fallacy that one of the functions of the higher executive is to authorize the breaking of rules. Even Bill Holland, usually such a sane and sensible counsellor, says that, "Management is knowing when to bust rules," but he is wrong, for once. Yet that sentence is the only wrong one in the argument he sets forth.

Some years of experience as an executive have convinced me that in any business the rules laid down by experience should always be strictly adhered to by everyone. If, when the general manager wants something done in a hurry, all rules may be broken providing he gets what he asks for, his juniors are sure to feel that when they want something doing in a hurry to satisfy him, the rules controlling those lower down may be neglected in a similar way.

The eventual result of such methods is chaos. Every business has a system of entering orders in and out, requisitioning material, invoicing, and so forth, all, of course, controlled by various rules, and these must be followed. The result of meeting an urgent call for material for the works by telephone orders, for example, and the sending through of requisitions and official confirmations later, is one that has often resulted in the purchase of unsatisfactory material.

On the other hand the argument that "rules are rules," just as an argument, is indefensible. Now, Phil Parker is quite in the wrong. He has taken the attitude that shop rules are as inflexible, and yet, if he is the manager, he surely made them, or at least can alter them. It seems that he is in danger of falling into a very deep rut, indeed. Further, if rules could be designed always to run a business, and modification and other control were unnecessary, the results would be farther-reaching than Bill Holland suggests. They would eliminate executives entirely and considerably modify overhead. But possibly a few "policemen" would be necessary to see that they were carried out.

—C. NORMAN FLETCHER, *England*.

Rewards for Suggestions

A suggestion system can be made of benefit in any shop, even a small one, but only if handled automatically and intelligently. The men need to have the benefits of the suggestion scheme kept constantly before them. This can be done by handing out each month individual slips to every employee announcing the prizes for the coming month. Another means is the printing on the timeslips of a few words, calling attention to the suggestion scheme, as for instance, "We are always glad to have our men make suggestions for changes in fixtures, appliances and tools to facilitate the work. If an idea occurs to you, write it out and put it in the suggestion box. Prizes are offered for the best suggestion."

A successful business represents an accumulation of the ideas of many men. Hence, the suggestion of plans for the betterment of products and methods, by the rank and file, as well as by the line and staff, is worth every encouragement.

Suggestion systems are usually operated on the basis of an award each month, consisting of three or five cash prizes, and mention of the names of others making good suggestions which did not win prizes. Much of the force of a suggestion system is lost if the suggestions for which prizes are given are not put into practice. Annual rewards for those suggestions which have resulted in the greatest good during the year, in addition to the monthly awards, will tend to round out the system. —M. BUSWELL.

· BOOK · REVIEWS ·

RECENT ECONOMIC CHANGES IN THE UNITED STATES—A report by the Committee on Recent Economic Changes, of a survey made by the National Bureau of Economic Research. Two volumes, nine hundred fifty 6x9-in. pages, total. Cloth board covers. Published by the McGraw-Hill Book Company, 370 Seventh Ave., New York. Price $7.50 for the two volumes.

BROADER understanding of economic forces, more general co-operation in avoiding pitfalls, and a large measure of self-restraint on the part of all elements of the business, financial and industrial world, have resulted in the period from 1922 to the beginning of 1929 being of unusual stability as well as of intense activity, according to the report of the Committee on Recent Economic Changes. This report is the third survey growing out of the President's Conference on Unemployment for 1921, the former two reports having to do with business cycles and unemployment and with seasonal operation in the construction industries. The Committee drew its conclusions from data obtained by a survey undertaken by the National Industrial Conference Board beginning in January, 1928.

A group of foremost business and labor leaders and economists are members of this Committee as follows: President Herbert Hoover, chairman, Walter F. Brown, Renick W. Dunlap, William Green, Julius Klein, John S. Lawrence, Max Mason, George McFadden, Adolph C. Miller, Lewis E. Pierson, John J. Raskob, Arch W. Shaw, Louis J. Taber, Daniel Willard, Clarence M. Woolley, Owen D. Young, and Edward Eyre Hunt, the secretary.

Following the report of the Committee will be found twelve chapters dealing with the detailed investigations made by the Research Bureau. These are under twelve chapter heads covering the following topics: Consumption and the Standard of Living, Industry, Construction, Transportation, Marketing, Labor, Management, Agriculture, Price Movements, Money and Credit, Foreign Markets and Foreign Credits, and National Income and Its Distribution. The chapter on industry is divided into three parts, the first being prepared by Dexter S. Kimball on "Changes in New and Old Industries," the second by L. P. Alford on "Technical Changes in Manufacturing Industries," and the third part by Willard L. Thorpe on "The Changing Structures of Industry."

CONTINUOUS RISE IN LIVING STANDARDS

Acceleration rather than structural change is the key to an understanding of the recent economic advancements of the nation, and the maintenance and extension of the economic balance between production and consumption is suggested by the Committee as the means of insuring an increasingly prosperous future for the United States. The Committee bases its prediction of a continuous rise of living standards on the maintenance of high wages in the light of "insatiable commodity demand," an increasing application of scientific and management skill, and on the elimination of speculation. The skillful application of "the principle of equilibrium" in every economic relation, if the nation is to "maintain our economic advantage or fully hopes to recognize our economic future," is the "outstanding fact" pointed out by the survey. The conclusion is that economically we have a boundless field before us, and that there are new wants which will make way endlessly as fast as they are satisfied.

Advancing use of automatic machinery, it is agreed, caused "technological" unemployment, as displaced workers were forced to find jobs elsewhere than in their original industry. But the increasing output of goods and increasing demand for sales and services in connection with their use, and increase of leisure and consumptive wants developed in leisure are said to have provided a field for filling the employment gaps.

The Committee believes that as long as the appetite for goods and services is practically insatiable, and as long as productivity can be consistently increased it would seem that we can go on with increasing activities. To do this a technique of balance must be developed by economists, engineers, and statisticians such as those who prepared the survey.

The Committee notes a rising standard of living which has reached the highest level in our history. The unskilled worker has been transformed into a skilled worker by specialized automatic machinery and processes, with production unit costs lowered, drudgery eliminated, and wages maintained or actually increased. The general rise in living standards is perhaps best explained by the fact that the cost of living has been practically stationary while wages have risen.

The report gives in condensed form an accurate picture of our entire economic structure and should be studied carefully by executives. Details pertaining to any one particular field or problem may be obtained by further study of the survey.

SIMPLE AERODYNAMICS AND THE AIRPLANE. By Charles N. Monteith and C. C. Carter. Four hundred eighteen pages, 5¾x8¾ in. Published by the Ronald Press Company, New York. Price $4.50.

THIS is the third edition, the revision including the results of much of the development work done by the National Advisory Committee for Aeronautics at their Langley Field laboratory. It is essentially a textbook designed for use in military academies, but will be found of value by anyone who desires to become familiar with the principles of airplane flight, the stresses imposed on the structure, and many other important points.

Thirteen chapters cover the various factors of airplane design and performance while over two hundred illustrations make the various points clear. Particular attention has been given to the work of the N.A.C.A., the text showing how the various problems are studied by means of specially designed apparatus. Any student of airplane design, construction, and performance will find the book a valuable addition to his library.

AIRPLANE STRESS ANALYSIS. By Alexander Klemin, head of the Guggenheim School of Aeronautics, New York University. This book, which is based on a series of articles that appeared in *Aviation*, has been written with the collaboration of George F. Titterton, B. S., who formerly was connected with the Bureau of Aeronautics, Navy Department. It has been prepared purely as an introductory treatise of the subject of airplane stress analysis for the use of college students, engineers and designers. The price of the book is $7.

Executive Considerations in Tool Design and Production

By M. H. Flynn

Factory Manager, Allen Manufacturing Company

A production estimate is highly important as it determines the type of tools and equipment. A temporary halt should then be called on model changes, and the designer should make an accurate list of his requirements

UNLESS the tool designer is in very close touch with the details of the business, which is seldom the case, he does not possess the facts that will enable him to decide upon the probable volume of production or the best type of tool to design, and a decision on both should be made before tool designing is started, because the amount of production required daily has an effect on the type of tool. For a new product, simple machines and low cost production tools just good enough to insure duplicate parts may be satisfactory, while for the same parts, after a market has been established, highly developed automatic machinery may be used to obtain the volume of production and low cost to meet market requirements.

Sometimes, expensive machinery is built for parts that will never be made in quantities large enough to pay for it. More frequently, on the other hand, the first set of tools is not good enough for the required purpose. The mistake is often made of using old or obsolete machines in bad condition, and cheap tools that cost too much to set up and operate, thus making the cost of the first few lots of parts excessively high. Also, when this is done, the tools must be rebuilt too soon for good economy.

An advance production estimate can be made after a little study, and the probable production over certain periods can be forecast by the management so that the right type of tool may be designed to start production. Then later on, as sales and production increase, the tool designer, from his experience with the preliminary tools, will be better able to produce the very best type of tools for the operations.

Some operations can be done efficiently only in machinery designed especially for them. But these single-purpose machines are justified only when labor savings can be made or quality improved to an extent that will cover the cost in a short period of time. The best plan for any operation, especially for a new product, is to use standard machines with as simple tools as will do the work effectively.

Often, when it is found that a special machine must be designed for an operation, a little study of the part or mechanism to be made will develop a new design of part that can be made with standard machines and tools. This study of the part should always be made before starting to build special machinery or complicated tools.

When a tool is to be replaced, a study should again be made so that the right type will be designed. In this case production requirements are known, and new methods and designs may be considered. Comparative studies of designs and costs of several types of tools and their effect upon cost and quality of production may also be made with profit.

In starting a new mechanism in production there will be enough problems to solve without trying to develop new methods, machinery, tools, or materials. The savings made by new methods or processes, if successful, are often offset by the cost of development and experiment. It is much safer to work with standard tried and proved methods and materials until the product is a success. Experiments may then be paid for out of profits and made at leisure, when there are no pressing production problems.

The methods employed by companies putting out new products will illustrate this point. Most of the well-known, successful machines that have run into large production were

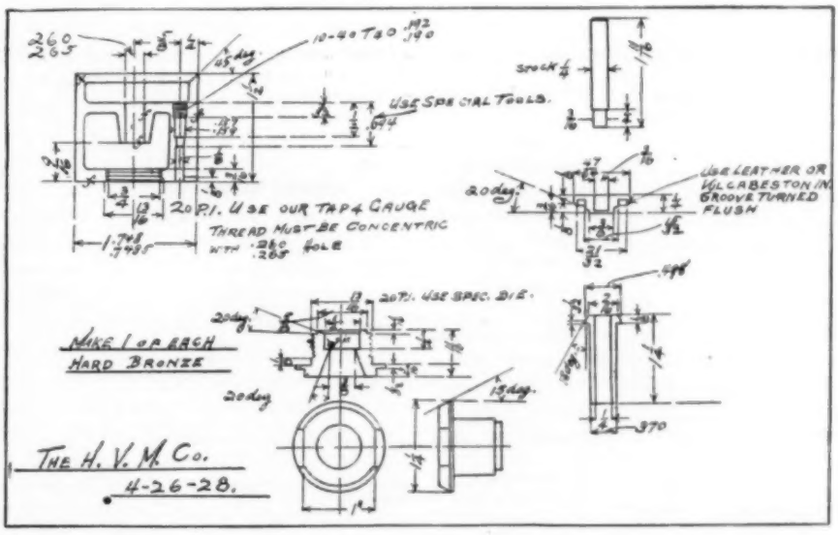

USE SPECIAL TOOLS
20 P.I. USE OUR TAP & GAUGE
THREAD MUST BE CONCENTRIC WITH .260 .265 HOLE
USE LEATHER OR VULCABESTON IN GROOVE TURNED FLUSH
20 P.I. USE SPEC. DIE
MAKE 1 OR EACH HARD BRONZE
THE H. V. M. Co.
4-26-28.

Fig. 15—This sketch is furnished by the designer for giving exact dimensions to the model maker for a proposed change in part. It contains all dimensions required to produce a permanent drawing of the part for production after the model is made and finally approved

The third part of the article. The fourth part will appear in an early issue.

PART LIST

C 10	Base		
C 15	Base Rivet		
C 16	Spring		
C 19	Follower		
C 22	Tube		
C 25	Tube With Base		
C 28	Complete Assembly		

NUMBER AND ORDER PLAN

C 10	Part Number	TC	1001 Tool Construction Order
C 10	Part Drawing Number	TC	1001 Tool Drawing Number
C 1001	Operation Number	TC	1001 Tool Number
MC 1001	Manufacturing Order	PC	1001 Part Pattern Number

TC 1001 P/1 TOOL PATTERN NUMBER

TC 1001 P/2

Fig.16

Fig. 16—Typical grouping and numbering of an assembly showing method of designating tools and patterns for showing their relation to the parts. Fig. 17—Typical operation list and equipment requirements for producing the first part C 10 of the base assembly shown in Fig. 16

These typed pages are the first and second sheets of a plan and operations list of a job that was put into high production quickly by careful planning in advance. The complete list for the whole job was written before any work was done. A building was erected, machinery and equipment purchased, tools designed and built, all to schedule. The production ran to 1,000,000 of each part a month in six months from the start.

C 10 BASE OPERATION LIST

NO.	OPER. NAME	OPER. ATOR	TOOL	MACHINERY	EQUIPMENT
1	Blank 44 in 1-lb.	1-M	8 Punch Holders 8 Die Holders 8 Punches 8 Dies 1 Gauge	1 #19 Bliss Press 1 Countershaft with Pulley	1 Belt Guard 1 Bolster 2 Stock Benches 2 Boxes 1 Chair 2 Belts 1 Pulley
2	Tumble			1 Barrel 1 Countershaft with Pulley	1 Pulley Main Line 2 Belts 4 Boxes 1 Belt Guard
3	Mill	3-B	2 Special Fixtures 2 Gauges #1005 Cutters H.S.Steel	4 Hand Millers 4 Countershafts and Pulleys	4 Cutter Guards 4 Belt Guards 8 Work Pans 2 Chairs 4 Pulleys
4	Burr	3-B	Emery Laps 2 Discs for Laps	2 Grinding Heads 2 Countershafts with Pulleys	8 ft. Bench 4 Belts 2 Pulleys 2 Chairs
5	Drill	5D-G	60 Drill Jigs	30 Sigourney Presses 1 Drill Grinder (one man do all drill grinding)	55 Chairs 55 Belts 30 Pulleys 18 Bending Cans 100 Work Pans

Fig.17

first made with the most simple and inexpensive machines and tools. Wooden drill jigs and bending tools were used. Hand operations were employed to save machine and tool cost. As sales increased better tools were installed, until today the most up-to-date equipment has been purchased from earnings.

On the other hand there are outstanding cases where well-known unsuccessful machines were started with the finest obtainable machinery and tools, purchased and made with no real regard for production or quality requirements, thus setting up an overhead burden, before sales started, that could not be obsorbed. Ventures have been unsuccessful because the inventor insisted upon the use of new, untried materials or methods, when standard materials and methods might have been employed successfully at first.

Careful planning in detail of the work leading up to toolmaking will greatly facilitate the tool work and decrease its cost. This planning ought not to be confined to a study of operations and the tools to perform them, but it should include a complete list of all parts of the device to be reproduced, a detailed drawing of each part, an operation list for each part, a tool list for each operation, and a production system.

It is, of course, possible for a man, either working alone or with assistants, to make a set of tools to reproduce a model, even a complicated one, without writing out any of the work outlined above. Such a man must have an orderly mind, an excellent memory, and he must know his job. But he will do a better job in a shorter time, with less strain on himself, and with an assurance to his employers that the job can be finished by some one else, if he should be incapacitated, and he will have time to supervise the actual work of designing or making the tools, if he will make a complete list of all the work to

RECORD OF CHANGES FOR PRODUCTION—BARR-MORSE CORPORATION

Change Part No._____ New Part—New Device

Name of Part or Device_____

To Drawing or Sketch Dated_____

*Signed by*_____

Model Made and Tested_____

Reason for Change_____

This space to be used for any information regarding this change.

*Approved*_____

Copy of this Order Sent to Drafting Dept.

By_____

Fig.18

These forms are employed in a typewriter plant with part lists, Figs. 9 and 10, to record changes made after the original lists have been written

CHANGE MEMORANDUM NO._____

DATE OF PRINT

Dwg. No._____

Type_____ Date_____

Attention of_____

Name of Part_____

SUPERSEDES ALL PREVIOUS PRINTS

Exact Nature of Change_____

Reason for Change_____

Takes Effect_____

Parts Made to Old Prints Should be_____

Cancel Job Order No._____ Lot_____ To Lot_____

Substitute Job Order No._____ Lot_____ To Lot_____

By_____ Ch'k'd_____ App_____ _____ Dept.

Fig.19

Figs. 18-19 — Change forms used after parts are in production

ACCOUNT No.	DATE	PART No.
PART NAME		

NEW PART

DO NOT MIX WITH OLD STOCK

THIS TICKET MUST ACCOMPANY FIRST LOT THROUGH THE SHOP. STOCK CLERK WILL HOLD THESE PARTS UNTIL ALL PARTS LISTED ON CHANGE MEMORANDUM

No._____REACH STOCK.

Form 103 SM 1-30-28

Fig. 20—This "New Part" card is red in color and goes through the shop departments with the first lot of changed parts to the assembling room. It is used in the same factory with the forms shown in Figs. 18 and 19

Nº 14851 **Shop Practice Change**

Name J. J. Brown

Following Change Requested/Suggested) By R. Smith

Dept. 621

Date 11-15-28

Name of Part or Location: Fan Lever Stud

Part No. 13169 | Operation: Turn 1-1/8" dia. and turn thread dia. face flange undercut, chamfer thread, chamfer and cut off.

Oper. No. 1 | Mach. No. and Name: 1-7/8" Cone Auto. Screw Mach. #17242

Describe Change and Reason Therefor

Please redesign form tool #7486 Detail 6.

To provide less top rake.

To break up chips and increase life of tool.

See R. Smith for details.

Cost _____ Saving _____

No change from shop practice as specified in Planning Department Operation Sheets is to be made until this form properly filled out, has been approved by:

Scovill Supt. _____ Master Mechanic _____ Planning Dept.

Fig. 21—When changes occur in operations or methods used in producing a part this form is employed to notify the design department to change the tools and also to notify the production department of the change in method. This form is used in a large automobile plant

be done and then see that all the details are carried out.

When there are thousands of parts in one machine or mechanism, a list of some kind must be written, but the listing and planning may be made just as effective and profitable for small mechanisms. Such a list has been used to great advantage even in reproducing a mechanism consisting of only six small pieces. It is assumed, of course, that the management has seen to it that accurate and detailed drawings of each part have been prepared.

The idea of writing a list of work to be done is elementary, yet machines are often started without doing it. The usual result is that, when the work is supposed to be finished, the discovery is made that something has been forgotten. Sometimes these forgotten items cause weeks or months of delay, and they must be made in a hurry at additional cost. Expensive errors, omissions, duplications, and delays may be avoided by listing the job in the beginning and checking off the work as it progresses. The constant studying of the list in selecting new work and checking off finished work has the additional advantage of disclosing errors and short cuts that cannot be seen in other ways. A complete, accurate list of all the work to be done is essential, and makes possible quick results at low cost.

The first list to write is one containing all of the parts of the model or mechanism to be reproduced. In some industries this part list is used for many purposes. First it is very carefully written to show every part of the machine including each small screw. Usually the machine is divided into separate mechanisms or assemblies. Each group is given a symbol and a series of consecutive numbers arranged to allow for expansion and changes. In some types of machines, where changes in one model are frequent, or where one model is to be made for a long time, a considerable allowance must be made for expansion. Several methods are in use for this, but the decimal system is the favorite one.

When the list has been written, it is made the basis of a production system for ordering and controlling the working drawings, models, patterns, purchases, tools, manufacturing work, and finally for part sales and service work in the field. As changes are made in the mechanism, even those in the early stages of model work, the list is corrected in such a way that it will show at any time the parts that have been put in as well as those taken out of the mechanism. All additions and changes are indicated.

This should be done carefully and systematically so that after machines have been sold, skeletons of the list may be given to the sales and service departments to show assemblies and parts that may be required by the user as they appear in successive models. A simple method of recording these changes and notifying everyone interested is the issuing of a change note to all concerned.

The list writing and maintenance should be under the control of one person in the engineering department. It is so important that it is often supervised by the chief engineer, especially when changes are being made in the product.

The part list may be used effectively by the tool designer in his own work. After a production machine or a tool has been designed, especially if it is not a simple one, the work of detailing the parts will progress much faster, and in a more orderly manner, if the designer is required to write a complete list of all the parts of the tool, including screws and nuts. The close scrutiny that must be given the drawing when writing the list will often bring to light interferences and errors in design that might not be noticed otherwise, until discovered by the toolmaker.

If the list is not written before the draftsman's attention is given to the detailed drawings, important parts may be forgotten until the toolmaker tries to assemble

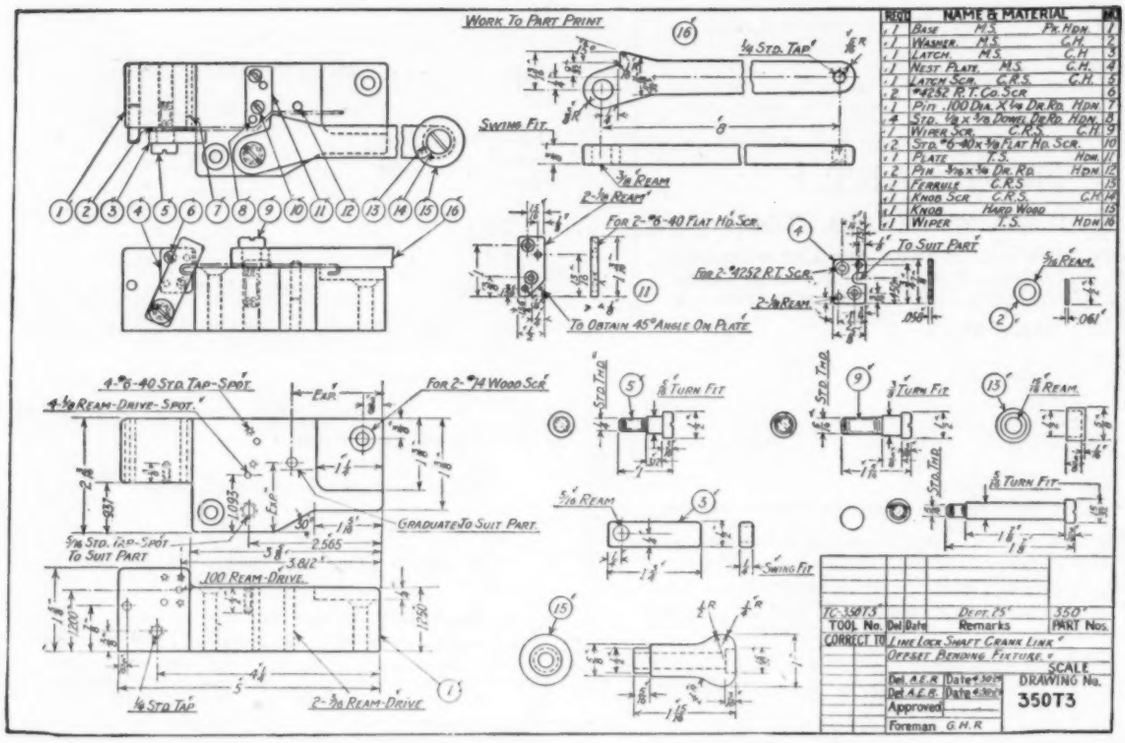
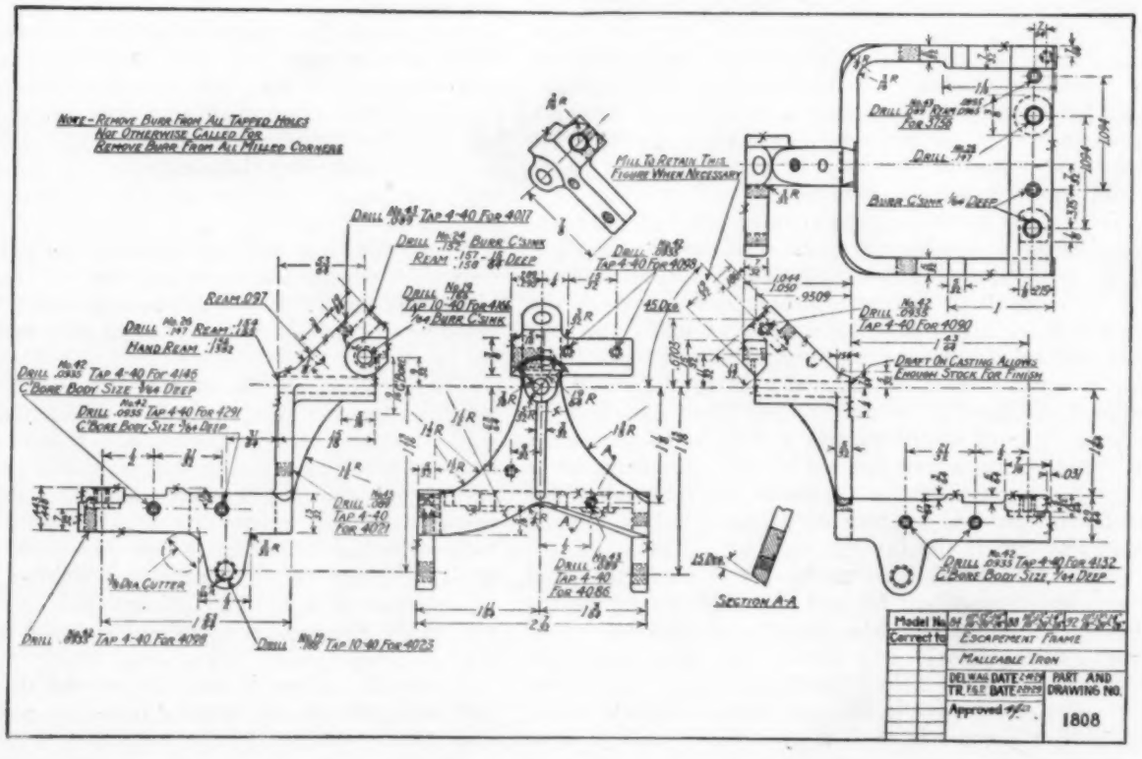


Fig. 22—A typical part drawing made on a large scale giving minute detail. All information needed by the pattern maker, tool designer, tool maker, and production foremen is given

Fig. 23—A typical tool drawing used in a high-production plant

In order to prevent delays, arguments, and spoiled work in the shop, the tool drawings are made showing an assembly of the tool around the part and details of each tool part. The tool foreman has one blueprint for his use and another to cut apart, if he chooses, so that he can have several men working on the same tool at once.

Whenever a foreman asks for a special tool or is critical of tools furnished to his department, he is asked to study the designer's drawing and to approve the design before the detailing is done. In this way cooperation is obtained, and also the experience of the production department is considered.


NOTE—REMOVE BURR FROM ALL TAPPED HOLES NOT OTHERWISE CALLED FOR
REMOVE BURR FROM ALL MILLED CORNERS
MILL TO RETAIN THIS FIGURE WHEN NECESSARY
DRILL TAP 4-40 FOR 4017
DRILL BURR C'SINK REAM .157-.156 DEEP
DRILL TAP 4-40 FOR 4098
DRILL TAP 10-40 FOR 4116 BURR C'SINK
REAM .097
DRILL REAM HAND REAM
DRILL TAP 4-40 FOR 4145 C'BORE BODY SIZE 3/64 DEEP
DRILL .0935 TAP 4-40 FOR 4291 C'BORE BODY SIZE 3/64 DEEP
DRILL TAP 4-40 FOR 4021
45 Dia.
DRILL .0935 TAP 4-40 FOR 4090
DRAFT ON CASTING ALLOWS ENOUGH STOCK FOR FINISH
DRILL .0935 TAP 4-40 FOR 4132 C'BORE BODY SIZE 3/64 DEEP
DRILL TAP 4-40 FOR 4086
15 Dia.
SECTION A-A
1/8 DIA CUTTER
DRILL TAP 4-40 FOR 4099
DRILL TAP 10-40 FOR 4023
Model No.
Correct to
ESCAPEMENT FRAME
MALLEABLE IRON
DEL. WAS DATE
TR. TO DATE
PART AND DRAWING NO.
Approved
1808

the tool. If the list is carefully written and the parts checked off as details are drawn, all of the work will be done with certainty and without confusion. The concentration required to select and list all of the parts fixes the details of the parts in the designer's mind with the result that the drawings will be prepared much easier and in a shorter time.

If this list is written before the detail drawings are made, the screws, nuts, taper pins and other standard parts, and often the sheet metal and bar materials may be ordered and purchased while the detailing progresses. This gives the purchasing department time to obtain materials without being forced to write rush orders after toolmaking has been started.

This list may be used to great advantage by the toolmaker in scheduling his work, and by the purchasing department in summing up the materials requirements. Because he knows all of the details, the designer can write such a list much more quickly and accurately than the stock or toolroom clerk or the purchasing agent. If the designer is required to train himself to write an orderly list of his designs before drawing the details, it will be found that the otherwise tedious detailing work will be easier, and that his work will also be more acceptable to toolmakers and others who must use it. The comparatively small amount of time spent writing a list should return big dividends to both the design department and the management.

Men Over Forty-Five—*Discussion*

By L. C. Newton

TO QUALIFY on my right to enter into this controversy, let me say that my experience has led me through the ranks of employee and employer as toolmaker, draftsman, assistant superintendent, superintendent, general superintendent, works manager, general manager, and once I occupied the chair of president. This experience extends over a period of 35 years, in plants employing up to more than 5,000 hands. I also have a college education, obtained at two of the finest universities in America, as a foundation.

The idea of setting the "dead line" at 45 years of age is fundamentally wrong, an insult and injustice to every honest wage-earner, and we are all wage-earners, from day-laborer to president. Let us see how it works out:

A young man is graduated from college at the age of, say, 21 years, and decides upon a manufacturing career. He starts at the bottom, and, at the end of four or five years, has advanced to the point where he is making forty or fifty dollars a week. At this time the idea of a home enters his mind, and in the course of the next seventeen or eighteen years, his son, or daughter, is ready for preparatory school or university. All of the earnings of the father up to this time have gone into the home and into the education of his children, in the majority of cases. Probably the home is partly paid for, a mortgage is carried on the balance, and the bank account is nearly into the red. Father is now between 40 and 45 years of age, and, with fifteen years of ripe experience, is at his best. He is a capable worker and figures he has a business connection good for many years ahead. Then the crash comes.

A new president comes into the picture, with the usual new ideas. The employee with long service is thrown out, through no fault of his own, except that he is 45 years of age, and considered too old to absorb new ideas. This is the age of the young man. Now the real struggle takes place. No one wants him, he is too old. Physical condition, ability, experience, judgment, dependability, all are worth nothing in the eyes of the employment manager. "The big boss has set the dead line at 40 years of age and you are out of luck." These are actual facts as exist today, and I have proved them personally.

What are we going to do with these men who are in their prime? The money they have earned is in their homes and in the education of their children, who will take our places in the near future. Their saving time is now, and in the next ten or fifteen years. They cannot live without money, and that means employment, and they are told they are too old to work at 45 years of age.

Personally, any man who can "do his bit" shall have his job in my plant, be he 45 or 65 years of age. Some of my best men have been near the latter age. Any employment manager who will consider only a man from the age standpoint, will last with me just long enough to receive his pay check.

Let us go into the 35 to 45 age limit as it affects the executive. One of my acquaintances in the manufacturing world, with twenty years of experience, from serving his time as apprentice, to the position of works manager, through one of the tricks of the whirligig of fate, lost his position. He is an exceptional man. His experience and credentials are beyond question. After some thought on the subject, he placed his case in the hands of several employment service experts, and to a man they said he would have no difficulty in locating a very satisfactory position.

The various experts got busy and he paid the bills, from $50 to $300 per expert. In due time letters commenced to arrive. In one particular case a lead developed, a real one, worth $18,000 per year. Letters were exchanged, photograph and credentials furnished, age and experience stated. All seemed satisfactory; "You are just the man wanted. Will you meet me in New York?"

My acquaintance went to New York from Boston, at his own expense, and there met the employment agent, who was working for another party. These are the agent's words: "I did not notice that you are 45 years of age. Your experience is just what my principal wants, but I will not recommend any man for a job who is over 35 years of age."

We see advertised positions for executives who "must be of mature judgment, college men, with at least ten to fifteen years executive experience, not over 35 years of age." I have before me as I write a publication that calls for eight executives, all to be key men in organizations, to have big responsibilities, and to be from 30 to 40 years of age. Again I ask, what is to become of the men who, losing their positions at 35 years of age, are not allowed to work because they are too old? Dame Fortune has been good to me, my day is done, my hair is gray, and the time has arrived when I must, of necessity, soon be putting my house in order. Personally I have no axe to grind. But I am happy to say that I have never had the nerve to tell a man who was 45 years of age that he was too old to work.

Aluminum Chair Production

Photographs by courtesy of the Aluminum Company of America

Fig. 1—The frames of the chairs are made from extruded seamless square and rectangular tubes of a high-strength aluminum alloy. The lengths are sawed to the correct sizes on circular saws, and notched where required on band saws as shown at the left

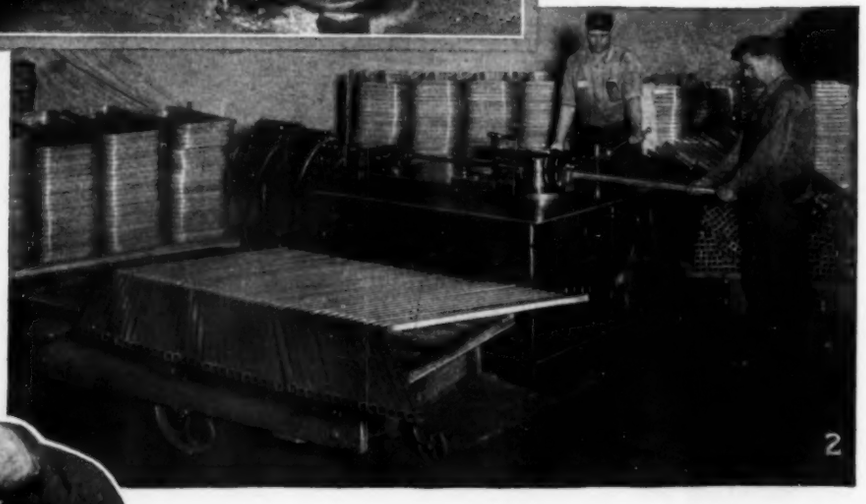
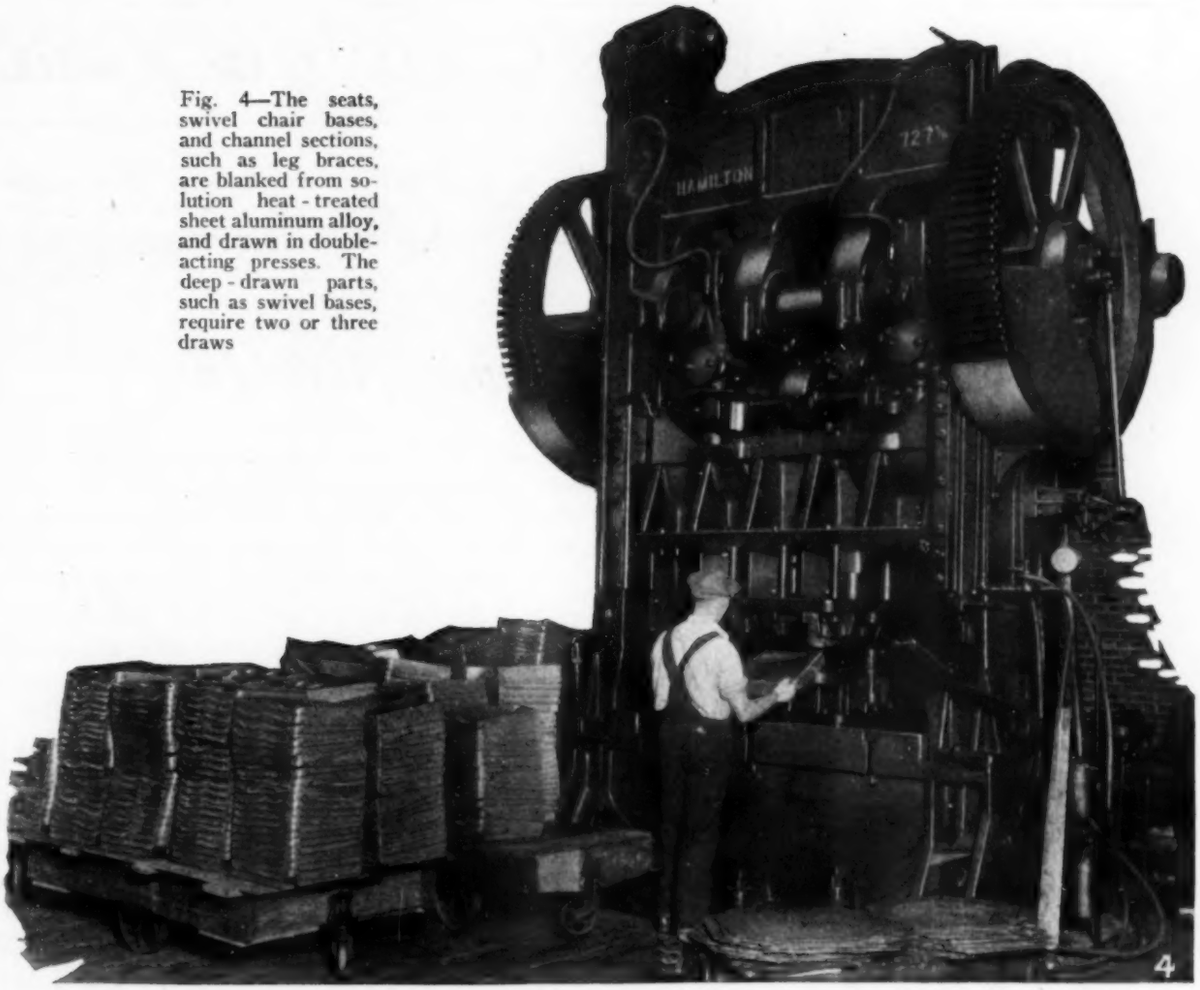


Fig. 2—Forming of the frames is done in power-driven rolls, as illustrated at the right. A flexible jointed metal "snake" is put inside of the tube in order to prevent crushing in of the walls of the tube. This jointed string is removed easily after the bend is made

Fig. 3—Jigs are employed for the welding operations. Sub-assembly jigs are used for back frames and other sections, and these are finally grouped into complete assembly jigs to complete the chair. In general the assemblies are only tack-welded in the jigs, and then completely welded at the bench by other workmen in order to utilize the jigs to full capacity. The jig frames are of cast iron.

Fig. 4—The seats, swivel chair bases, and channel sections, such as leg braces, are blanked from solution heat-treated sheet aluminum alloy, and drawn in double-acting presses. The deep-drawn parts, such as swivel bases, require two or three draws



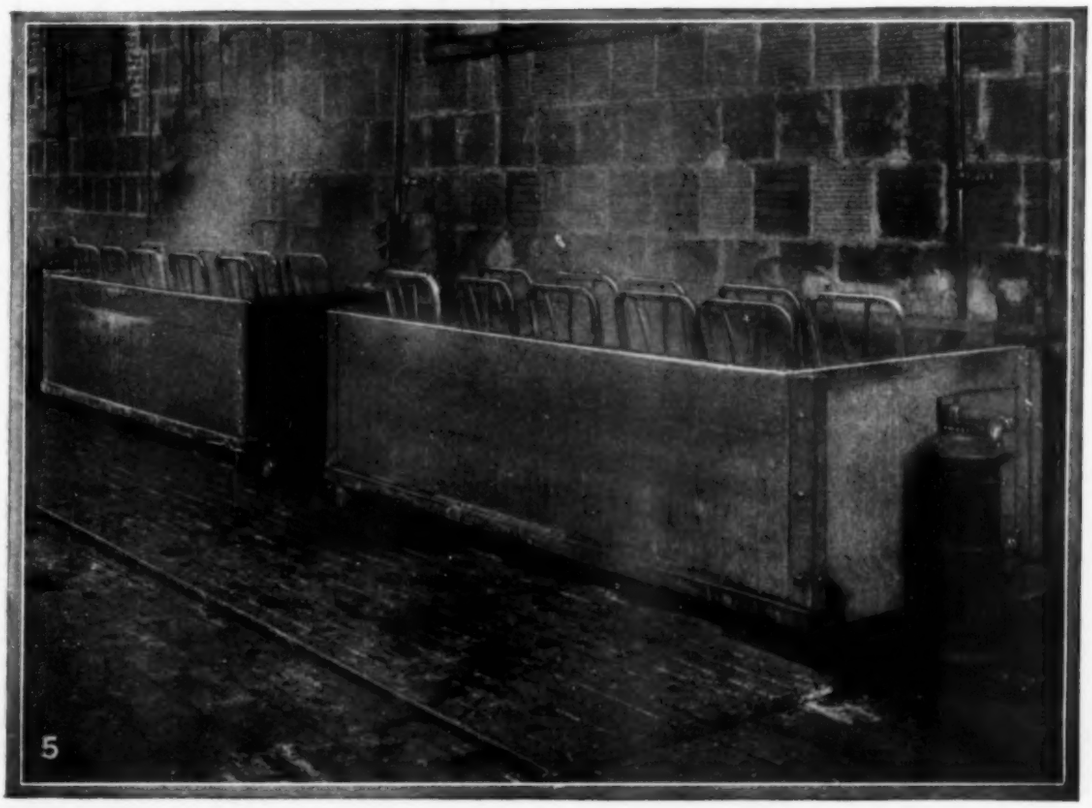


Fig. 5—After welding, the flux and grease is washed off thoroughly in a hot bath, and the chairs are ready for the finishing operations

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Reporting Minor Accidents

"THIS no-accident record business is getting my goat, Al, and I'm afraid it's going to cause a lot of trouble before they decide to forget it."

"What's eating you now, Ed?" spoke up his fellow foreman. "Come on in the office and sit down. Something must be wrong to bring you over here during working hours. Welcome to the department."

"It's this way. Everybody is out to get that big sign plastered up in the department 'No lost-time accidents since January!', and they've got it, too! But that sign and that idea is all the bunk, Al. We haven't had any lost-time accidents because nobody reports them any more!"

"Go on with your story, Ed; that sign has been worrying me, too."

"Well, you see, when a fellow gets hurt now he keeps still about it because he's afraid the other men will blame him for spoiling the record. The shop rules say a man has to report for treatment for everything, and the first-aid room is the judge of whether the man has to lay off or not. But the way it works out is that now the men are their own judges as to how bad the hurt is, and these slight injuries cause a lot of trouble because they're not taken care of.

"Bob Jones has a poisoned foot because he dropped a casting on it last week and didn't have it treated, and Bill Warner has been walking around all week on a strained ankle that he got when he slipped off a pile of steel. And, what do you think? Bill Smith's wife told my wife yesterday that she thought it was a shame the way the company isn't paying any attention to injuries any more!"

"Why not penalize the men who don't report their injuries, Ed?"

"Wouldn't do any good. It's like other laws we know about—you'd have to fire everyone in the department."

"Ed, I'm glad you are the fellow who is doing the kicking, instead of me. Williams knows that I was not in favor of putting up those signs, so I had to keep still and give them a chance. But if you go and tell him what you've told me maybe he'll take it up and have them removed."

"Was it Williams' idea, Al?"

"No, it was one of those bright young scouts in the office. But Williams allowed them to be put up even though some of us kicked, probably because he felt that he had to give it a trial because it came from the office."

"So long, Al. I don't have to consider the feelings of the office, so I'm going to scoot for Williams right away."

Is it necessary to "tell the world" with big signs about shop welfare records, or was Al correct in his argument that small things will be neglected for the outward show? Aren't educational methods better than trying to force a situation?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Al Orders an Emergency Pump

NOT only has Al shown real reasoning ability in diagnosing the situation, but to my mind he went about it in the most practical and direct way, to carry out his conclusions. I see no reason why he should have had to wait until Williams' return, and I'm glad to note that Williams is the kind of executive who encourages an organization to function in his absence.

As far as the treasurer is concerned, I don't even see why he had a right to call Al "on the carpet." Since Al followed the straight line of executive control and went to Williams' assistant in the absence of Williams himself, any questioning by the treasurer should have been directed at Williams' assistant, who had the authority and exercised it. In fact, not only do I disagree with the treasurer as to the facts in the case, but I also feel that he failed to recognize the established line of authority when he took the matter up with Al instead of with Williams' assistant. —HARRY PLANT.

An Unemployment Fund

AN INTERESTING experiment is a scheme being used by an association of manufacturers in Cleveland. Under their plan, each member-manufacturer guarantees to give his employees, who do not leave voluntarily, or are not discharged justifiably, twenty weeks of work during each half year. If the employer does not provide the guaranteed period of work, his employees are entitled to two-thirds of their respective minimum wage during the unemployed part of the twenty weeks.

The employer deposits each week 7½ per cent of his direct payroll in a common pool, thereby building up an unemployment fund. At the end of each six months' period, that portion of his deposit which has not been paid out to his workers for unemployed time, is returned to him.

If the worker is able to secure work elsewhere during his lay-off his right to draw unemployment pay is not affected. This rule constitutes an incentive to the employer to keep his men busy. —EDWARD V. PIRANIAN.

THE unemployment fund as discussed by Al and Ed seems to be a very poor means to an end. The cost of investigation, records, and other details necessary to the intelligent administration of such a fund would leave but a small portion of it for actual relief purposes. There are men who, under no circumstances, would apply for such donation. There are, of course, others who would follow the line of lease resistance. In the case presentation, the former employer paid the worker the difference between what his pay was when he was laid off and what he was then able to earn; but how long would such a scheme last? This is far beyond the moral obligation of any employer, and we have not yet reached the millennium. Our own plant, like others, has its dull periods, not many and not recently, but during the readjustment period after the War, we faced the necessity of short time. Our plant manager met the situation by decreeing that no one was to be laid off. First, the working time for the week was reduced to five days, and later to four days, but all employees worked during that time. Fortunately, the tide turned shortly after this and we resumed full time with our organization practically intact. —E. F. WEIMAR, *Asst. Cost Accountant, DeLaval Separator Company.*

Spending Money for Oiling Equipment

SYSTEM in oiling, as in everything else, is good, but a complicated system often gives rise to greater evils than it cures. Unless there is a continuous supply of oil under pressure long oilpipes are likely to be more unreliable than an oiler. The changes in temperature of a bearing together with the pumping action of the shaft rotating will sometimes suck a pipe dry with the result that unless the pipe slopes downward all the way it will get no more oil for several days and will consequently sieze. Again, an oiler is more likely to miss one of a large number of similar oilers all in a row, than one of an equal number of dissimilar bearings on a machine which he knows.

Where a continuous pressure feed is impracticable the pipes should be gathered into small groups. They should be as short as possible, slope downward and should be drip, or wick fed from a common reservoir. Such an arrangement for the press in question may cost more, but it will be effective, while the mile of pipe and 200 oilers all in a bunch is little more reliable than the old fashioned method and, if the machine has to stand for several hours a day, it is just as costly. —H. JAMES, *England*

Shall Men Clean Their Own Machines?

MY CONTENTION is that the man who takes pride in keeping his machine clean is the man who produces good work, and that the man who takes pride in his machine and his work will eventually bring himself to the attention of his foreman and the officials of the company through his efficiency and dependability.

The man who operates a machine week after week should be able to clean it in less time than it would take a cleaning crew. If the operator knows he must have his machine clean before he leaves on Saturday noon, he will take occasion to clean or brush it off every day, keeping it in fair condition all through the week, and thus avoiding a big job on Saturday. If he depends upon a cleaning crew to do it, he will leave the vicinity of the machine cluttered with cuttings and dirt, and will "pass

the buck," claiming that cleaning is what they are getting paid for.

Now for the commercial side: Suppose a customer came to place an order, and asked to make an inspection of the shop. Would it create a favorable impression to find things in an untidy and slovenly state? The chances are that he would hesitate in placing his order until he had inspected other shops, and it is more than probable that the neat and systematic shop would receive more consideration than the untidy one.

—FRANK FURRER, *Foreman.*

THE idea of having a crew clean machines after working hours is worthy of consideration. The idea of blowing off the dirt and grease by steam, however, makes one ask, where does it all go to?

Production machines should always be cleaned by a cleaning crew, as they are usually operated by unskilled labor on piece work. These men have no interest in the machine apart from its output, and if the cleaning is left to them, it is usually "skimped."

On the other hand, machines operated by skilled men on high class work should be kept in a reasonably clean condition by the operator himself.

The cleaning crew should be under the supervision of the maintenance department, as the cleaner may often notice some small thing out of order which can be put right before further damage is done if reported promptly.

—F. C. TWIST, *Ontario, Canada.*

MECHANICS, like other people, are influenced by their environment. If the shop is well regulated and kept clean they will usually keep their machines clean. On the other hand if the management pays little attention to cleanliness the shop will soon be a mess. Machines should be kept clean at all times, rather than cleaned at intervals. Having a crew go around cleaning the machines might have the effect of causing some of the employees to neglect them. Most operators have plenty of time to clean their machines while they are in operation, and it is not necessary for them to quit work early every Saturday in order to clean up.

In our organization, we have a "Good-housekeeping Plan" that has proved a success. Inspections are held regularly and a certain number of demerits are given for unclean machines, paper lying on the floor or anything pertaining to bad housekeeping. Every two weeks the three departments having the least number of demerits for that period are awarded prizes of $15, $10 and $5 respectively, according to their standing. The departments winning the prizes raffle them off among employees working in that department. This system seems to inspire foremen, as well as other employees to keep the plant clean, and the management considers the $60 a month well spent.

—W. J. OWENS.

WE HAVE this cleaning problem in our shops, and so far we have not found a satisfactory solution. First, we issued instructions that every man in the shop should clean and oil his own machine every evening at ten minutes before the time of leaving. This system was bad, because men on piece work never would finish the last piece of their task on time, and complained that those ten minutes were lost by them, and besides, the ten minutes lost by every man was equal to the labor of some ten men each day.

Next, we ordered that the cleaning should be done after working hours, and a prize was offered for the best kept machine during the month. Also one for the man cleaning his machine and leaving the shop the quickest. This was worse still; men asked for overtime, the cleaning was irregular and the leaving tumultuous.

At last we organized a gang of men, not like floor sweepers, but specialists, and with some knowledge of electric maintenance, to clean and oil the machines out of working hours. We got better results, but even this system lacks control, and is at times inefficient, but it is better than either of the others.

—FAUSTO BECERRIL, *Military Engineer, Chapultepec, Mexico.*

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THE · NEXT · TOPIC

"Paying a Bonus for Temporary Work"

Spending Money for Oiling Equipment

Summary of the Discussion

Al has told his fellow foreman that the present method of oiling is unreliable, and that an individual pipe lead to each bearing will pay for itself many times. Ed combated this idea as a waste of money and held that present methods are satisfactory.

ONLY one writer disagreed with Al and he seemed to feel that a positive pressure feed is preferable. The others contributing to the discussion gave various reasons for supporting Al's contention. One stated that while good operators are reliable, they are few. He cited as an example one of William's cartoons showing an operator who had been oiling the center hole in the top of the drill press spindle for 18 years.

Several hold the opinion that an automatic machine should have positive methods of oiling, as no matter how conscientious the operator may be, eventually he will neglect the oiling and some bearing will "freeze" up.

Only one writer advocates another method in preference to the oiling equipment. In his shop the machines are divided so that an oiler lubricates definite machines each day, and some of them at definite times in the day. The opinion seems to hold that this subject is important at the present time and will become more so as the cost of machines increase.

Experiences With
White-Metal Car Bearings

By C. B. Lord
Associate Editor, American Machinist

In the case described it is found more economical to assure car mileage by efficient maintenance, rather than depend on the bearing material

OPERATING efficiency in a transportation system is expressed by the average car-miles per year of its rolling stock, the total mileage being divided by the total number of cars owned, not by those in service only, and the ideal condition is a small number of cars kept in service as continuously as possible. How few cars can be used to maintain a given schedule depends upon how small a percentage of them are in the repair shop at the same time. This in turn depends upon the efficiency with which repairs are made, and how soon the cars return to service.

There are two definite checks upon such a program, first: a sufficient number of cars to maintain the schedules must be kept in commission; second: the maintenance cost per car-mile will indicate whether an excessive amount of labor and material is being employed to keep the fewer number of cars in service.

Experience has shown that allowing a car to remain in service until its withdrawal is compulsory will not accomplish the desired result, and is the reverse of economy. It follows, then, that periodic inspections, frequent enough to anticipate serious trouble, and compulsory shopping at as long intervals as can be justified, are necessary. The key to the situation is this shopping interval, and since it is impossible to build a trolley car equally strong in every part, like the "one horse shay," every facility by which cars can be kept in service, or returned to service quickly, must be studied from the angle of both car-mileage and cost per-car-mile.

The management of some railway systems believe that in making their own major repairs they can control the length of time the car is out of commission and operate with fewer cars. Others believe that operating economy is better served by replacing a troublesome unit immediately and returning it to the manufacturer for repair, holding that he has superior facilities and knowledge.

Doing it one way involves additional capital investment for buildings and machine tools, and the other way requires added equipment to take the place of the units being repaired, and paying someone a profit for doing the work.

The former method was chosen by the United Railways and Electric Company of Baltimore, because the company's engineers decided that it was necessary to make every repair, major or minor, if they were to control the shopping time of their equipment and obtain the maximum car-mileage with the minimum number of cars. Periodic inspection and minor repairs are made at the different car-barns, and the major ones at the Carroll Park Shops.

It became evident before long that the shopping periods of the cars were too close together, and that a larger percentage of them were in the shop at the same time than was consistent with the policy adopted.

Analysis of shop records showed that the two-car trailer type was the cause of the most trouble and that they could not maintain a schedule comparable with single cars because they could not accelerate quickly enough to get out of traffic jams, and that the attempt to do so was a source of trouble. The suburban type of car was considered too cumbersome for congested areas, so a new type, a three truck articulated car was developed. This car pivots on a central vestibule which affords free entrance and exit regardless of the relative angle of the two parts of the car and it can accelerate so quickly from a stop that an automobile, also starting, cannot cut in ahead of it. This car is being built by a large car-building concern under license and is being adopted widely.

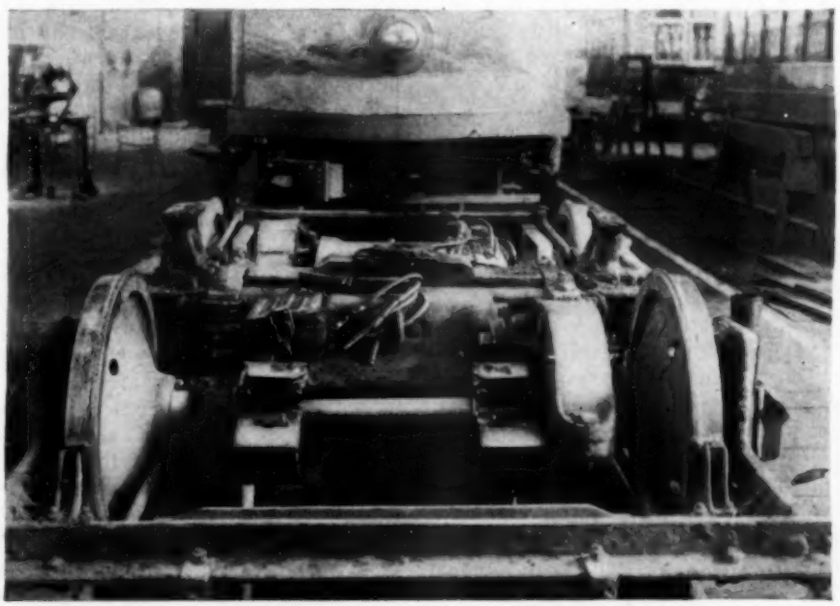


Fig. 1—Car truck with auxiliary oil cellars that extends the out-shop time of the car, and increases the life of the bearing

The next most

troublesome item was bearings, and it was found quite early that the outshop cycle of a car depended primarily upon its bearings, and the same time and thought were given to this trouble as was given to the trailer car problem.

When purchased new, a car truck is equipped with bronze bearings throughout, axle journals, motor-frame bearings and armature bearings. The engineers of this company consider bronze bearings merely an insurance against careless lubrication or insufficient facilities, an insurance on which they must expect to pay premiums periodically in expensive new bearings, and continually in greater power consumed.

When received, the motor axle bearings are provided with oil reservoirs packed with wool waste. Leakage and lack of capacity make it necessary to supply oil to these boxes oftener than once a month. To lubricate them properly at this interval would mean taking care of 60 or more cars each day in order to be sure to include each of 1,400 cars every month. This procedure would mean either the maintenance of an oiler at each of the car barns day and night, or the neglect of the oiling, and since the maker knows from experience that they will be neglected, he furnishes bronze bearings.

The simple alternative is to provide sufficient lubricant to last from one shopping to the next, either by preventing its loss or by increasing the capacity of the reservoir. In this case both have been done. The reservoirs on the motor bearings have been increased to carry a supply of lubricant sufficient to last from one shopping to the next, and flanged leather washers have been fitted to the axle journal.

The result of this redesign has been that the original bronze bearings on the motor and truck journals are replaced by a lead-antimony bearing as fast as they wear down to the prescribed limit. These lead bearings besides reducing the cost of replacement in both labor and material, reduce maintenance costs by lasting longer than the bronze ones. The life of the truck journal is 2 years and that of the motor bearing 10 years.

Ordinarily, the tendency is away from babbitt bearings, and it would be considered very poor economy to substitute a cheap lead bearing for bronze, but the practice of this company demonstrates that it is the condition of the bearing that counts most, not the material from which it is made.

That first cost is not the controlling factor, however, is shown by their armature bearing practice. We have here a speed so high that lead will not answer the requirements, and an 80 per cent tin mixture that costs more than bronze is used. Armature bearings are vital: To melt one or wear it down too low means grounding the armature and burning out the motor. It requires undoubtedly a great deal of confidence in one's methods to use a soft metal in such a place and reverse the practice of the makers, but the United Railways have justified their policy. The life of a babbitt bearing at this place is between three and four years, which exceeds that of a bronze one.

With all of these bearings the original sleeve or shoe is used for the babbitt or lead lining after it has worn to the limit allowed. Used this way these shoes act as wear gages and make periodic inspection easy. The axle journals for instance are "pulled" at the car barns by the inspector, based upon records of their time in service. If the bronze or steel shows through the babbitt they are replaced with others. If the lead is very thin they are scheduled for another inspection.

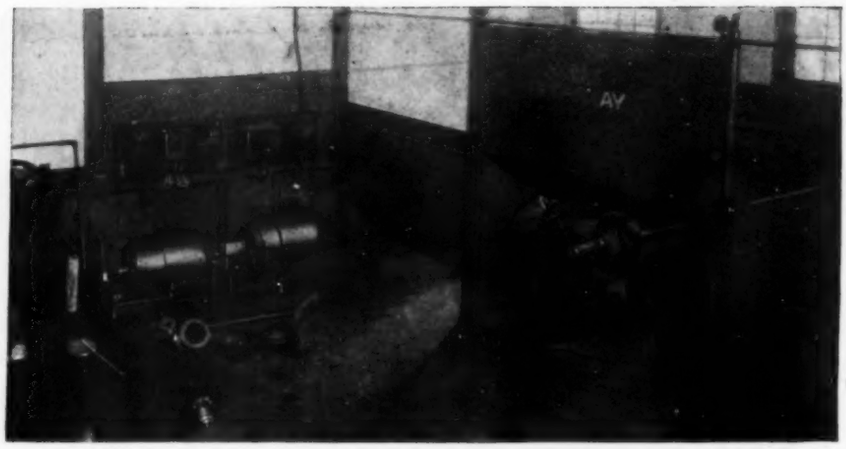


Fig. 2—Welding the groove in the end of the axle where the horseshoe thrust washer goes. This welding is being done in a pit where the arc cannot be seen from the floor. In addition each welder has a separate booth with a lift front to permit entrance of the large piece

A point that research in this car-shop has shown is that no matter how near perfect a bearing may appear, changing the bearing shoes around increases the power consumed and wears them down sooner. The reason for this is that smoothness is apt to be judged by light reflection and not by flatness, and when bearings are shifted about the "hills and valleys" on axle and bearing will not accommodate themselves one to the other.

In the present case some of the "hills and valleys" may be occasioned by the practice of not grinding the axles. They are smooth turned, then polished with emery and oil. Because of this lack of mating when exchanged a bearing is fastened to its own axle.

Just as much attention is given to the prevention of sideplay in the truck bearings. Usually this is a prolific source of trouble in street cars. The effects of excessive sideplay—and even a small amount is excessive—are: lurching of the car, wear on running parts and gearing, and slapping of oil from lubricated surfaces. No way of compensating for wear is provided in a new car truck except the renewal of the cheek brasses that take the thrust. The company's practice is to cut a deep groove, ½ in. wide, near each end of the axle and insert a bronze horseshoe washer that takes the thrust. The life of these washers is not long, and it is necessary to watch them, but they are not expensive and are easily renewed. One of the routine inspections at the different car houses is to inspect the thrust collar and replace it with a wider one when the "not go" gage will enter between the side of the groove and the washer. When the groove wears too wide or its corners become rounded it is welded as shown in Fig. 2, and recut.

The net result of all these methods is that each of the 1,400 cars of the system makes 32,000 miles each year. To maintain this average means that the shoppings must be extended so that not more than 1½ per cent of the cars are in the shop at the same time, nor can the average time in the shop exceed 5 days twice a year. This must include painting, repairs, and motor burnouts.

Production Results with Tungsten-Carbide Tools

By Henry J. Long and W. Paul Eddy, Jr.
Chief Experimental Engineer *Assistant Metallurgist*
Brown-Lipe-Chapin Division, General Motors Corporation

Extensive experiments in the plants of one automotive company with the new cutting tools show their superiority for specific applicaitons

IT IS in order at this time to present the results of some actual experiences in the fabrication of tungsten-carbide tools and of successful and unsuccessful attemps to apply them to various types of work, so as to assist in the readjustment of manufacturing practices which must necessarily take place in order to allocate to tungsten carbide its true place in industry.

The brittleness of tungsten-carbide alloys is a property which encourages the use of a large, and especially a thick, tip in relation to the size of the cut to be taken. The factors limiting the tip size may be the cost of the material, the necessity for ample support of the cutting tip by a stronger and tougher material, or the space available for the operation of the tool. It is also necessary, in designing a tool, to consider chip space, especially in the case of a multiple-edged tool, in order that there be no likelihood of chips becoming packed on the tool face to the extent that chipping of the edge results.

Experiments carried on by the authors under actual production conditions indicate that considerable machine time can be saved, and the tool life very much extended, by the use of tungsten-carbide tools on gray and malleable-iron castings

The comparative weakness of this material demands as sharp a cutting angle as possible, in order to reduce the chip pressure. To use a large rake angle, however, without crumbling at the edge, absolute rigidity is essential. As more sturdy machines are built and as fluctuations of power application are lessened, it will become possible to use steeper cutting angles. The angles are not the same, of course, for all jobs, but depend upon character of material being cut, type of tool used, speed, feed and condition of machine. As an example, we are using on lathe tools for malleable cast iron a front rake of 5 deg. and a side rake of 5 deg. We have hopes of increasing these angles for steel as we approach freedom from vibration in operation.

Inasmuch as heat generated in the tool is relatively unimportant, we find it possible to use broader-nosed tools of tungsten carbide than of high-speed steel, thus distributing the cut over wider areas and lengthening the life of the tools.

Partly in the interests of economy, the company with which the writers are associated is studying methods and technique of making tools tipped with tungsten-carbide alloy. This is, perhaps, a field in itself, yet it is one with which we believe every user of these tools should be familiar. With money tied up in such expensive material, it is imperative that the investor be in a position to use it as efficiently as possible and to eliminate losses resulting from delays in procuring, regrinding, repairing, or remodeling tools.

Inasmuch as it is usually impossible to purchase a piece of tungsten-carbide alloy of nearly the size required in a tool, the first problem encountered is that of removing from a small bar or stick of the alloy a piece of the desired size and shape, with minimum effort and with the least possible loss. In the first place, the bar of alloy should be purchased with its application in mind, so that two dimensions of the proposed tip will have been fulfilled. Then it would appear merely necessary to cut the length desired by means of a thin grinding wheel of the special composition recommended.

We have never been able to cut completely through even a thin piece of this alloy with a grinding wheel. The piece always fractures before the job is finished. By feeding the disk carefully so as not to heat the alloy excessively, and by turning the piece so as to grind into two opposite sides or perhaps into all four sides, it may be possible to cut away two-thirds of the section before the piece cracks. The discouraging feature is that, even with these deep notches carefully ground, the fracture is no more likely to occur between the notches than anywhere else, with the limitation, of course, that it always starts in one of the notches. We have found, after many trials, that to grind on one side only directly into the piece until it cracks is sure to result in a flat fracture in the desired plane.

With this method the feed of the wheel into the work, within reasonable limits, appears to have little influence on the result. The fracture, with any method, usually does not begin at the lowest point of a notch, but rather at the side of its rounded bottom, on a line with one wall of the notch. The notching should not be attempted by hand, but should be done on a small surface grinder. We are using a 7-in. wheel, not less than $\frac{3}{8}$ in. thick, on the circumference of which has been dressed a rim ap-

Abstract of a paper delivered at the Rochester Meeting of the A.S.M.E., May 13-16.

proximately $\frac{1}{16}$ in. thick and $\frac{1}{4}$ in. wide, with fillets at the shoulders and with a rounded edge.

The next step is mounting the tips on the holders. Firm support is of paramount importance. The tip must fit its seat closely, and should have contact over not less than three sides. Blades of multiple-edged tools, such as reamers and facers, may be made of thin flat pieces of the alloy, which should be mounted in slots sawed at angles of 10 to 12 deg. to the direction of motion at the cutting points. This method results in locking the blades against the pressure of the chip, which would otherwise pull out the blades during operation.

The brazing may be done by heating the holder and tip in a furnace having an atmosphere of nitrogen or hydrogen, using copper as the brazing material. Good results can also be obtained, however, without such a furnace, by heating in the flame of a blow-torch, provided that a brass alloy be substituted for copper. The strength of a well brazed joint of brass may not be as great as that of an equally good copper joint, but owing to the fact that the brass flows more freely, a complete filling of the joint can be made much more easily under the blow-torch than with copper.

Machine Lapping Developed

The tip or blade may be ground to its final shape after mounting. We have occasionally encountered tips which by their crumbling defied all our efforts to grind a good edge. Various methods of impregnating several materials with fine abrasive for use as laps, as well as many ideas on lapping processes, were investigated to overcome this difficulty. We developed machine lapping with an aluminum disk on which was brushed a fine silicon-carbide paste. This served the purpose fairly well, although there were still some edges which required finishing with a hand lap of brass. Of late, however, both grinding wheels and our technique seem to have improved. We find that a fixed position on a surface grinder results in a rounding or crumbling of the point; consequently we grind by hand, moving the tool across the side of the wheel. Good results in roughing are obtained with a certain Czecho-Slovakian silicon-carbide wheel and with 60 I to 80 I Crystolon wheels. For finishing, a 100 I Crystolon wheel is satisfactory. Wheel speeds are approximately 3,400 r.p.m. We now rarely find it necessary to resort to lapping as the finishing operation. We feel, however, that further improvement is possible, possibly through the use of a still finer finishing wheel.

As is well known, the properties of tungsten-carbide alloy point to the low tensile materials as the field of greatest service. We have found a number of operations on malleable-iron castings to which these tools are applicable. One of these is the breaking down or chamfering of the flanges of differential case castings. The operation is the first performed on the rough casting. One typical case requires a chamfer of about $\frac{1}{4}$ in. on a flange 9 in. in diameter. Best previous results were obtained with Stellite, cutting at a speed of 72 r.p.m. with a feed of 0.014 in. The production per grind averaged 200 pieces. By simply replacing the tool with tungsten-carbide alloy, the average production jumped to over 7,000 pieces per grind.

On the same lathe set-up, the flange is rough-faced. Stellite was formerly used, making a cut $\frac{1}{16}$ in. deep, with a feed of 0.014 in., at the same speed as above, 170 ft. per minute; the tool life was about 150 pieces per grind. Tungsten-carbide tools are averaging 700 pieces each grind. The speed of these operations are at present limited by other tools, notably a reamer, on the set-up.

Finish-facing of the same flange is performed on another lathe. High-speed steel tools formerly used produced an average of 400 pieces per grind. Tungsten-carbide tools operating at a speed of 300 ft. per minute, with 0.013 in. feed, average 12,000 pieces per grind. These tools do not give quite as smooth a finish as did high-speed steel tools, but the big advantage of the former, aside from increased production, is the elimination of size variation. It was necessary for the operator to readjust the set-up several times during the life of a steel tool. With the tungsten carbide no adjustment is required throughout a day's run, and no difference in size between the first and last piece can be detected.

Another malleable iron application is that of line-reaming pinion bores of differential carriers. A double reamer $3\frac{3}{8}$ in. in diameter, each section having six blades, is run on one such job, at 80 r.p.m., removing about 0.015 in., with a feed of 0.052 in. High-speed steel reamers produced an average of about 1,500 pieces per grind, and each reamer had a total life of about 6,000 pieces. The tungsten-carbide reamers average 9,500 pieces per grind, and the life of a reamer is approximately 28,500 pieces. In this application better finish as well as less size variation is obtained with tungsten carbide. The rate of production, furthermore, has been increased approximately 20 per cent, as the high speed reamers were run at half the above speed with a little greater feed.

Now Beyond Experimental Stage

In all of the above applications the use of tungsten-carbide tools has progressed beyond the experimental stage, and these tools have been adopted definitely as standard on these jobs, simply because they have proved advantageous either from an economic or from a quality-of-product standpoint.

Certain pinion spacers are now made of malleable iron. In order to obtain greater crushing strength and to effect savings in material costs, it is desired to replace malleable with gray iron for these parts. Such a move, however, has not been found practicable when using steel tools, on account of difficulties in facing and boring which have invariably been encountered whenever the substitution has been attempted. The method of performing these operations on the malleable spacers is to use two boring bars—one for the two bore diameters, another with two blades for facing both ends to length simultaneously—on a lathe, all cuts being about $\frac{3}{32}$ inch.

The advent of tungsten-carbide tools, however, is making the desired move possible. Experimental work on this job has not as yet been completed, but it is indicated that these operations will soon be carried out on gray iron spacers on a drill press, using two double counterboring tools, each of which will face one end and bore the adjacent diameter. Each tool has six boring and six facing blades. The rate of production is expected to be double that of the present method. Not allowing for possible increased tool cost, the saving will probably be $1\frac{1}{2}$c. in labor and 1 to $2\frac{1}{2}$c. in material, per piece; and in addition the part will be superior to its predecessor.

We have been cautious in applying tungsten carbide to the machining of steel. Nevertheless, there is at present one important job on which a saving is being made by its use. Bevel drive gear forgings, usually of $3\frac{1}{2}$ per cent nickel steel, were formerly made with minimum ma-

chining allowances of $\frac{1}{16}$ in. on the backs and $\frac{1}{16}$ in. on the faces. The initial operation was to take a heavy facing cut from the backs of the forgings on heavy machines with high-speed steel tools. Owing to the powerful chucking required, an occasional forging was distorted so that, when it was removed from the machine after the cut, the back would not be quite flat. This condition caused trouble in subsequent operations.

The present method is to specify 0.070 in. allowance for machining on the face and to merely clean up the forge shop excess of $\frac{1}{32}$ in. to $\frac{1}{16}$ in. from the back with a tungsten-carbide facing tool, on a lathe. This means that a comparatively thin cut is taken on a surface so abrasive and at a speed so high that a high speed steel tool will not finish one piece. The remaining operations on the gear blank—turning, boring and facing—are handled in two set-ups on large vertical automatics.

The speed of the initial facing cut on a typical forging, which is $8\frac{1}{2}$ to 10 in. in diameter, is 120 r.p.m., or 267 to 314 ft. per minute. The feed is 0.020 in. A tungsten-carbide tool will face 150 to 175 pieces per grind, and will have a total life of 3,000 to 4,000 pieces. Ignoring the former cost of high-speed tools, we find that a tungsten-carbide tool costing $24 and facing 3,600 pieces, does the work for $\frac{2}{3}$c. per piece. Against this we place an actual saving of 2 to 3 cents in material on each forging, an increase in production of finished gear blanks of at least 50 per cent, on a man-hour basis, and the elimination of warping troubles. It should be mentioned that difficulty was experienced in obtaining a lathe which would stand up under the high speeds required to make this facing operation economical, and that before such a lathe was used the tungsten-carbide tools gave much trouble in chipping as a results of lack of rigidity in the machine tool.

Certain Experiments Were Unsuccessful

We have been unable to make a cutting-off tool for automatic screw machines which operates successfully; every tool chips very quickly.

We have not been able to make a tungsten-carbide tool work satisfactorily on Mult-Au-Matics; the large overhang permits sufficient vibration to chip the tool.

This alloy has also proven ineffective in rough-turning the outside diameter of the flange of a certain differential case of malleable iron, owing to the irregularity of depth of cut.

We are still having some difficulty in either purchasing or manufacturing multiple-edged facing tools from which the tungsten-carbide blades will not pull out during operation.

We are attempting to face the backs of differential side gears; though we have some hope of ultimate success, our efforts have thus far produced but erratic results. A flat-faced tool $\frac{3}{4}$ in. in width feeding forward into the work 0.0017 in. each revolution under a speed of 100 ft. per minute has not performed consistently. In one case, for example, 4,700 pieces were faced in this manner before the tool needed regrinding; another time the tool broke so badly that it was ruined when less than 2,000 pieces were faced. In fact, we may say, in general, that the heavy pressures encountered in facing with a flat-nosed tool or in end-milling have made these operations very difficult to perform with tungsten-carbide tools. The locking of the tips or blades as mentioned above seems at present to be the only solution to this problem.

SEEN · AND · HEARD

By John R. Godfrey

Amaliting—The Best Metal for Bearings—Tail Centers

GOING to the opposite extreme of hardness in protective coverings from the much-talked of chromium we have a comparatively new process known as "amaliting." The coats the metal, steel in most cases, with a mixture known as "amaloy," in which lead apparently plays a large part. It is being used to protect the ends of automobile exhaust pipes from corrosion due both to the gasses and to condensation on the inside. Other parts are also protected against rust in a similar way.

This is a dipping process instead of electro-plating, the parts being first cleaned with suitable acid and then dipped in melted amaloy. According to reports it makes a very satisfactory protective covering, but the handling of the molten bath requires considerable experience to secure the best results.

* * *

YOUNG engineers who feel that everything worth while has been discovered and that little remains to be done, need not be downhearted until someone really proves whether cast iron or steel, or some other metal, makes the best material for cylinders, for pistons, and for piston rings. One group issues the edict that like metals never run well together, that steel cylinders require cast-iron rings. Others point to the fact that millions of motors are in use with cylinders, pistons and rings all of cast iron. And I recently found a steel cylindered motor with steel rings that was said to be doing splendidly. Strangely enough, these engineers also advocated steel rings for cast-iron cylinders, and seemed to have a reasonable experience to back it up.

Now comes a maker of centrifugally-cast cylinder liners who gives some interesting figures. Averaging the wear on several hundred cylinders he found a wear of a thousandth of an inch for each 1,732 miles with a cast-iron block, 1,172 miles with steel liners in the cylinder block, and of 3,494 miles when liners cast by the centrifugal process were used. Here is something for the young engineers to think about and perhaps test out when opportunity offers.

* * * *

TAIL centers on lathe work play an important part in the results obtained from the new cutting tools. The old tail center, perhaps fitting badly in the end of the spindle, is frequently unable to resist even an ordinary cut without springing. Then, too, they get hot with the work at high speed.

The usual answer is to put in some apology for a ball bearing center that increases the overhang and waves around under a heavy cut like a reed in the wind. Why not make the tail spindle big enough to put a good ball or roller bearing center inside the end of it? Then you have a spindle that will stand the pressure of the work on the tool and get an anti-friction center with even less overhang than is usual at present.

IDEAS · FROM · PRACTICAL · MEN

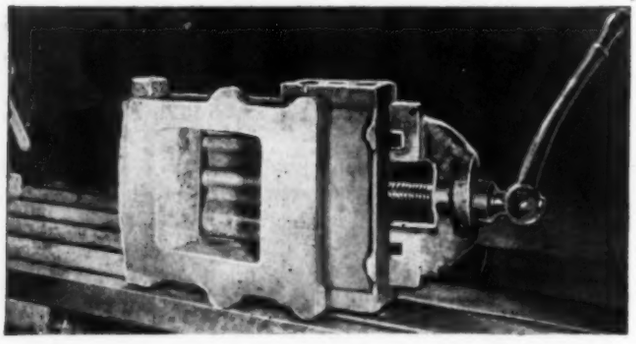
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Using a Chuck on a Face Grinder

By I. B. Rich

One of the problems of using a face grinder is to hold the work so that it can be easily and quickly located for grinding. In the operation shown the solution is to mount a shaper type of chuck on a suitable angle plate on the grinding-machine table. It is then an easy matter to put the work in place and remove it after grinding the face shown.

The work in this case is a cast-iron trailer journal box from which about $\frac{3}{16}$ in. of stock is removed on a Diamond grinding machine. The wheel used is a 24K Alundum and the floor to floor time is 5 min. each. The use of the chuck shortens the time on the operation and the same chuck can also be used on a large variety of work.



Using a chuck on a face grinder

A Substitute for Drop Forgings in Small Lots

By E. F. Fader

The difficulty of securing drop forgings quickly and at a reasonable cost for a small lot was met by a rather ingenious method in the course of one of our jobs. In this instance steel or alloy castings were not acceptable. The specifications called for fifty small drop forgings to be made from a good grade of steel, machined all over to fairly close limits, and heat-treated.

The best delivery we could get for the forgings was five weeks from the date ordered, and with the cost of the dies prorated over this small lot the completed cost would have been excessive. This caused as to look for some other way out, and as a result we developed what was to us a new method for making a certain class of small parts of irregular form.

The material for use with this method was available at once, the estimated cost was lower than with drop forgings, and by selecting the right grade of steel the mechanical requirements of strength, stiffness and hardness were exceeded. The fact that the parts were to be machined all over made this method of substitution feasible since this finishing operation was made a base or forming operation.

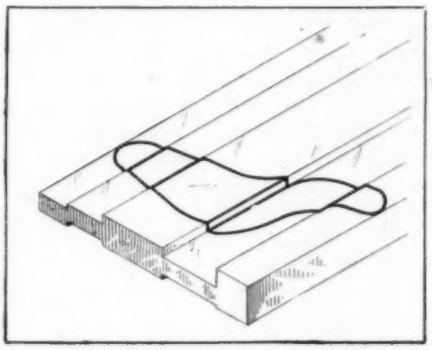


Fig. 2 — Outline of blanking operation on the milled section

The part illustrated was made by what we have come to term "the slab milling and punching process." For this purpose bar stock is used. The quality, in this case, was slightly better than specification requirements to offset any element of strength or stiffness that might have been given to the part by the forging treatment had forgings been used.

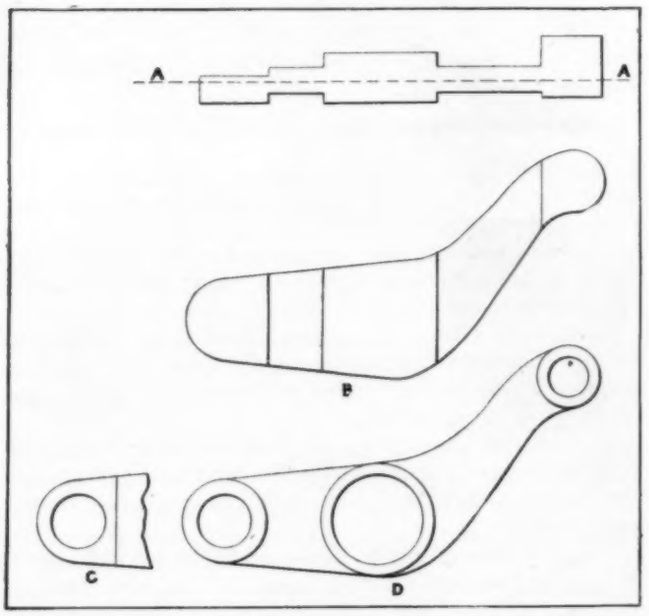


Fig. 1 — Slab-milled section and irregular shaped lever that was made from it

Minor design changes enabled the use of standard milling cutters and standard hollow mills. The cutters selected were "ganged" to produce a cut lengthwise of the bar similar to the profile above line *A* shown in Fig. 1. This profile was cut the entire length of the bar. The bar was turned over and the other side was milled with a gang of cutters that produced a cut to match the profile below the line.

In milling the second side it was found advisable to support the bar in a guide block, made of hard babbitt, to fit the previously machined surface. This babbitt block was made by casting the metal directly against the milled surface. The machining produced a bar whose cross section was the same as that of the finished part.

A punch and die was made to conform to the finished outlines of the part. The face of the die was cut to fit the profile of one side of the bar and the punch was machined to fit the other profile.

The bar with the outline of a part to be stamped from it is shown in Fig. 2. The parts as punched out appeared as in *B* Fig. 1 with irregular shaped hub bosses. In this condition the bearing holes were drilled and reamed. The hub bosses were then machined round with hollow mills having guide studs to fit the bearing holes. The finished parts were as shown at *C* Fig. 1. Following the heat-treatment the parts were given a uniform finish on an abrasive belt. The actual cost was about 30 per cent less than the estimated cost of drop forgings.

Truck Bumpers on Shop Doors

By R. E. Marks

Power operated shop trucks frequently cause considerable damage to shop doors as they pass through. No matter how careful the truck operator may be, it is very difficult to make time and still not hit swinging doors harder than is good for the doors.

To reduce damage of this kind the National Cash Register Company has put spring bumpers on both sides of all swinging doors through which the trucks pass.

The bumpers consist of a piece of substantial planking, hung at one end and protected with a metal plate that is curved to maintain contact with the projecting guard on the truck as it forces its way between the two doors. Between the bumper plank and the door itself, and near the free end, are several coil springs that permit a move-

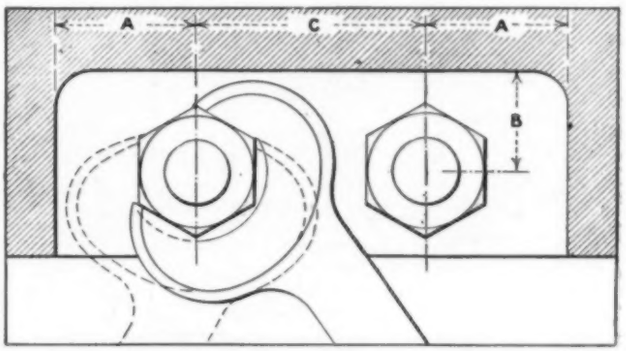
Protecting swinging doors from shop trucks

ment of perhaps an inch before the curved end of the bumper touches the door. This permits much of the shock to be absorbed by the springs and the device has proved very satisfactory in every way. It permits higher average speed with the trucks and saves much in repairs on the doors.

Dimensions of Recessed Pockets for Nuts

By A. Mitchell
Halifax, England

Where bolts are placed so that their nuts must be put on in recessed pockets, the draftsman is often at a loss to know how big to make the pockets to allow clearance space for the wrench. To avoid the necessity of laying out the clearance spaces of such pockets each time they



Bolt Diam. In.	Space A In.	Space B In.	Space C In.
1/4	3/8	7/16	1
5/16	11/16	1/2	1 1/8
3/8	15/16	5/8	1 3/8
7/16	1	15/16	1 1/2
1/2	1 1/16	3/4	1 3/4
9/16	1 1/8	15/16	1 15/16
5/8	1 5/16	1	2 1/4
11/16	1 3/8	1 1/16	2 5/16
3/4	1 7/16	1 1/8	2 1/2
13/16	1 1/2	1 1/4	2 5/16
7/8	1 5/8	1 5/16	2 3/4
1	1 7/8	1 1/2	3
1 1/8	2 1/8	1 3/4	3 1/2
1 1/4	2 3/8	1 7/8	4
1 3/8	2 1/2	2 1/8	4 1/8
1 1/2	2 5/8	2 1/4	4 3/8
1 5/8	2 3/4	2 3/8	4 3/8
1 3/4	2 7/8	2 1/2	5
2	3 3/8	2 7/8	5 1/8
2 1/4	3 7/8	3	6 1/4
2 1/2	4 1/4	3 1/8	6 7/8
2 3/4	4 5/8	3 5/8	7 3/8
3	4 7/8	3 3/4	7 3/4

Clearances for wrenches to turn nuts in recessed pockets

are to be drawn, I have prepared the accompanying diagram and table.

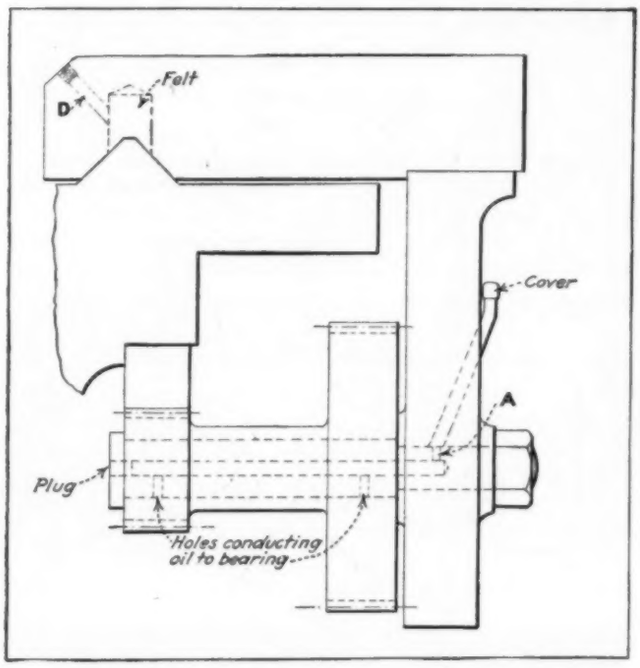
The dimensions given are the minimum ones allowable for the movements of wrenches on standard nuts. A table of this kind should be a great saving of time in the drafting room.

Better Oiling on Machine Tools—*Discussion*

By E. Someton
Glasgow, Scotland

The contribution by W. S. Rowell, page 330, Vol. 70, of the *American Machinist*, under the above heading appears to be a rather weak attempt at solving the problem of wear in the bore of the rack pinion sleeve and the stud, as several first principles of lubrication seem to have been entirely ignored.

In the first place, cutting a straight groove in a stud on which a wheel revolves is very bad practice as the groove tends to clean away the lubricant along a straight line in the bore of the revolving member with consequent risk of unlubricated metal-to-metal contact, but cutting a groove along the stud on the side which takes the reactionary thrust from the rack pinion teeth is by far



Suggested improvement in oiling a lathe apron

worse as this groove will break any oil film formed in the pinion bore and means rapid wear on the stud.

A better scheme is shown in the accompanying sketch. The stud is bored through the centre, and the end of the hole plugged. The oil is led into this through hole *A* while two radial holes, on the bottom—or non-pressure—side of the stud lead out the oil to lubricate the sleeve.

In the same sketch is shown a method of lubricating the top vees of the bed where the lubricator need only be filled once every week instead of once or twice a day as would be required with just the small oil hole shown by your correspondent. It will be seen that a large hole is drilled from underneath the saddle, this hole being packed with felt to which oil is fed through small hole *D*, the felt retaining the oil and lightly lubricating the vees constantly.

Using Four Radials Simultaneously
Discussion

By Donald H. Hampson

While I fully agree that using more than one radial may be economical in the case referred to on page 181, Vol. 70, and possibly in some other cases, there are other times and places where it does not work out that way.

The Muskegon Machine Company builds an automatic glue jointer that has a base casting 3x4x18 ft. To drill this efficiently two 5-ft. radials were arranged adjacent to each other, with their bases levelled at the same height.

Arranged thus, every hole in the frame can be reached by the head of one machine or the other. The weak point in this well-thought-out scheme is found in the difference in the age of the radial drill presses.

One might not think that design had changed enough in 10 years to make much difference in the drilling time on occasional pieces like this base. It has been found, however, that the newer radial is so much quicker that time is saved by having the base turned and all holes drilled by the one machine, while the older radial merely acts as a floor plate.

Adjusted Diameters for Circular Cutters

By C. W. Hinman
The Addressograph Company

The following simple calculations are based on the Brown & Sharpe standard undercut for cutting clearance:

H equals $\frac{1}{8}$ in. $\frac{5}{32}$ in. $\frac{1}{4}$ in. and $\frac{5}{16}$ in. for the Nos. 00, 0, 2, and 6 machines, respectively, and *D* equals 1.750 in., 2.250 in., 3.000 in., and 4.000 in., for the Nos. 00, 0, 2, and 6 machines, respectively.

The normal diameter of any cutter step is that diameter for a step if there were no undercut to be considered, therefore it is found by using $D - 2S$. *C* equals the constant per one thousandth of an inch of *S*, and *d* equals (D — $2S$ plus ($S \times C$). The constants are:

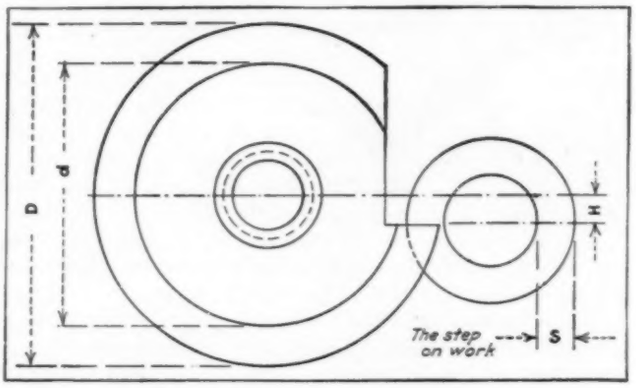


Diagram of cutter and work

For No. 0 and 00 Cutters, *C* equals 0.000025 in. for steps up to 0.250 in.

For No. 2 Cutter, *C* equals 0.000030 in. for steps up to 0.250 in. inclusive.

For No. 2 Cutter, *C* equals 0.000035 in. for steps from 0.251 in. to 0.375 in. inclusive.

For No. 2 Cutter, *C* equals 0.000040 in. for steps from 0.376 in to 0.500 in. inclusive.

For No. 6 Cutter, *C* equals 0.000030 in. for all lengths of cutting steps.

For Warner & Swasey circular cutters, where *D* equals $3\frac{3}{4}$ in., and *H* equals $\frac{5}{16}$ in., the same *C* is used as for No. 2 B. & S. Circular Cutters.

Suppose the step on the work is 0.031 in. for a No. 00 B. & S. cutter, then 1.750 in. minus 0.062 in. plus 31 times 0.000025 in. equals 1.689 in., which is the required diameter of the step on the cutter. It will be observed that the constants are easy to remember, being 25, 30, 35, and 40.

If the results are compared by using these constants with any table or formula the results will be found to be correct, frequently to the fourth decimal place. I discovered these constants many years ago, and have used them since with correct results. Any differences are so small as to be entirely within the toolmaker's limits of allowable variations. The designer may run over any of the limits given for these constants, i.e. over 0.250 in., or over 0.500 in., with correct results, but it is seldom necessary, since such deep cuts are seldom used.

Metal-Working Machinery Production in 1927

Compiled by the United States Bureau of the Census

	No. of Machines	Value Thousands of Dollars
Machine tools, total	.....	101,177
Bending machines	438	369
Boring machines		
Horizontal	255	1,412
Vertical	397	1,760
Broaching machines	255	372
Cutting-off machines		
Rotary cutter type	135	262
Hacksaw type	2,027	352
Drilling machines (except portable)		
Multiple-spindle	1,078	3,281
Radial	552	1,695
Sensitive	3,691	1,747
Vertical (upright)	1,795	1,517
Forging machines		
Bolt, nut, and rivet	663	1,830
Bulldozers and other	51	584
Gear-cutting machines		
Generator, hobbing type	803	2,238
Formed and disk cutter types, and other	230	627
Grinding machines		
Cylindrical		
Plain	1,007	2,926
Universal	408	715
Surface	934	1,695
Cutter, tool and knife	1,535	747
Internal	932	2,893
Other	.....	4,301
Hammers, stationary		
Drop	152	197
Steam, air and other power	283	341
Lathes		
Engine	6,700	7,132
Bench	1,050	216
Turret, including hand-screw machines	1,631	4,177
Other	1,525	6,399
Milling machines		
Hand feed	244	74
Power feed		
Plain	941	2,216
Universal	713	1,695
Vertical	488	1,598
Lincoln type	421	1,064
Planer type and other type	930	2,880
Pipe cutting and threading machines	2,281	1,344
Planers	235	1,852
Portable tools		
Drills, electric	.....	3,485
Pneumatic	11,627	1,109
Hammers, pneumatic	30,513	3,467
Grinders, electric	.....	1,453
Other	.....	4,291
Presses		
Hydraulic		
Bending, forming and forging	389	1,896
Power, for sheet-metal work	5,199	5,626
Punching machines, stationary	597	858
Riveting machines, stationary	1,336	664
Screw machines, automatic		
Multiple-spindle	825	3,322
Single-spindle	985	1,887
Shapers	986	1,629
Shears (power)	1,771	1,308
Slotters	32	199
Threading machines (except for pipe)		
Die type	538	546
Milling type	113	482
Tapping machines	484	585
Other machine tools	.....	5,880
Metal-working machinery, other than machine tools, total	.....	29,569
Rolling-mill machines	.....	7,774
Sheet-metal working machines	.....	15,673
Wire-drawing machines	.....	488
Rod and wire-working machines	.....	680
All other	.....	4,954
Metal-working machinery industry, all products	.....	191,262
Metal-working machinery	.....	130,746
Parts and attachments for:		
Machine tools	.....	35,569
Other metal-working machinery	.....	475
Custom work, repairs, and all other products	.....	24,472

According to the United States Census of Manufactures just compiled for the year 1927, the total value of all products of establishments engaged primarily in the manufacture of machine tools and other metal-working machinery was $191,261,792. The above details show that $101,176,776 was machine tools; $29,569,462 was "other" metal-working machinery; and the remainder was parts, attachments and custom and other work. The value of metal-working machinery made as secondary products by establishments engaged primarily in other lines of manufacture has not been compiled as yet. The value of these products in 1925 was $3,610,826.

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Established 1877

Personnel and Production

PERSONNEL work, which is our modern name for hiring and firing, is a much more important factor in manufacturing than seems to be generally realized. In too many cases it receives far less attention than does the purchase of raw materials. The good purchasing agent pays as much attention to quality of materials and to the reliability of the vendor as he does to price. He has the added advantage of having positive methods of measuring the various qualities desired in the materials. He can know in advance just what a piece of steel will give in the way of tensile strength, hardness, and wear. The personnel manager, however, has no such definite measurements as to men. Yet on the quality and capacity of the men he hires depends not only the output but also the safety of the capital invested in the plant. For even the machines that we are pleased to call fool-proof can usually be wrecked by a little unexpected carelessness.

The human element contains more variables than any materials that enter into construction, but few of them are considered as they should be in either hiring or firing. The effects of home conditions, weather, transportation facilities, health and shop conditions play an important part in the man's work, and bear directly on the output of the plant. Then too, the relative importance of the different factors varies with the temperament of the individual, and their effect on production is difficult to determine. We find shops where the conditions seem far from ideal, in which production is large and the efficiency is high, and others in which the reverse is true. The answer often seems to lie largely in the personal bond between management and men, and successful personal relationship is such an intangible thing that it is difficult to analyze it successfully.

The importance of this factor is, however, too great to be neglected. The personnel manager should receive careful consideration in every way as he usually makes the first and last contact with employees and can give a good or bad impression of the firm. The close relation of personnel to manufacturing efficiency is leading some concerns to consider making personnel a part of the production department instead of a separate division. In order for this combination to be successful, however, it is necessary that the production manager have an understanding of men as well as of machines.

A Blow at Important Statistics

IN STARTLING contrast to the progressive activities of the Bureau of Foreign and Domestic Commerce in the Department of Commerce at Washington, which have meant so much to American business and manufacturing, is the proposal of the Bureau of the Census of the same department to eliminate from the coming decennial census questionnaires questions that concern vitally important facts on manufactures. The only excuse given by the Bureau is that the taking of the census of population will require all of the available time and funds.

A more inopportune time to cut down on the securing of statistical information could hardly be chosen. Business is just learning how to interpret economic trends and how to base future plans on the interpretation. And now it is proposed to eliminate the gathering of information that is absolutely vital to the studies that establish trends. Some of the factors involved have been reported since 1849. Among the ones that are in danger of being dropped are these: Prime movers in manufacturing industries; Size of establishments by average number of wage earners; County statistics of manufactures; Hours of labor in manufacturing industries; Manufactures statistics for industrial zones; Capital invested in manufactures; Actual output, and maximum possible output.

Obviously, some of these items are more important than others, but all of them are important to some branch of business or industry and it would be a disastrous step to eliminate them.

Secretary of Commerce Lamont, and Assistant Secretary Klein, under whose jurisdiction the Bureau of Census comes, are both awake to the needs of business and industry and sympathetic with any proposal that will result in general benefit. Their position in dealing with the situation outlined here will be greatly strengthened if those who realize the importance of basic economic facts and are making good use of them will write a protest against the threatened retrograde movement by the Bureau of Census. Anything that is to be done must be done at once because the estimates for the appropriations and the questionnaires are now being prepared.

Long & Allstatter Straight-Side Tie-Rod Presses

FOUR sizes, known as Nos. 5-, 6-, 7- and 8-D made in various widths between the uprights, have been placed on the market by the Long & Allstatter Company, Hamilton, Ohio. These presses have a self-adjusting friction brake with large diameter drum, a spring balance ram on machines with jaw clutches, and steel gear covers. The lower parts of the connections are of the knuckle type giving a very large area where the pressure comes. The main members are made of semi-steel castings. Roller bearings are used on the flywheel shaft. The motor pinion is made of raw hide and the motor gear of steel with machine cut teeth. The crankshaft is made of a 0.45 carbon steel forging and runs in semi-steel bearings. Bronze bearings can be provided when desired. Various types of lubrication can be furnished, but individual grease or oil cups will be provided unless otherwise ordered.

As shown in Fig. 2 the clutch has hardened tool steel striking and backing inserts, which are made of 0.75 carbon steel. The clutch slides and drives on a squared part of the crankshaft and has four striking surfaces. It is operated from a treadle through an improved mechanism guaranteed to prevent knocking of the jaws while running idle. This construction also makes the clutch free releasing when being disengaged from the jaws on the main gear. This feature makes the clutch safe, as it cannot be engaged unless the treadle is depressed, and insures against a repeat stroke. The driving jaws for the main gear are part of a special forged steel plate, and bolted and keyed to the hub of the main gear. The main gear and jaw plates are bronze bushed. The clutch can be furnished to be operated by an electric solenoid connected to a foot-operated push button, which can be placed at any convenient position on the floor. Die space dimensions of the four presses can be changed to suit requirements. Dimensions common to all widths on the four models are respectively: Standard stroke of slide, 3, 3, 4, and 6 in.; adjustment of slide, 3½, 3½, 4, and 4 in.; maximum stroke, 6, 6, 8, and 12 in.; number of strokes per min., single geared, 37, 33, 16, and 14, double geared, 23, 22, 16, and 12; standard die space from top of bolster to bottom of slide, stroke down, adjustment up, 8, 9½, 12½, and 17½ in. Widths between uprights for the No. 5-D range from 37 to 97 in.; No. 6-D, 49 to 109 in.; No. 7-D, 49 to 121 in., and No. 8-D from 61 to 121 in. Weights range from 13,702 to 120,000 pounds.

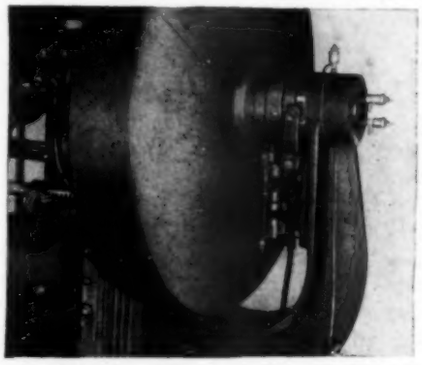


Fig. 2 — Close-up of the clutch mechanism

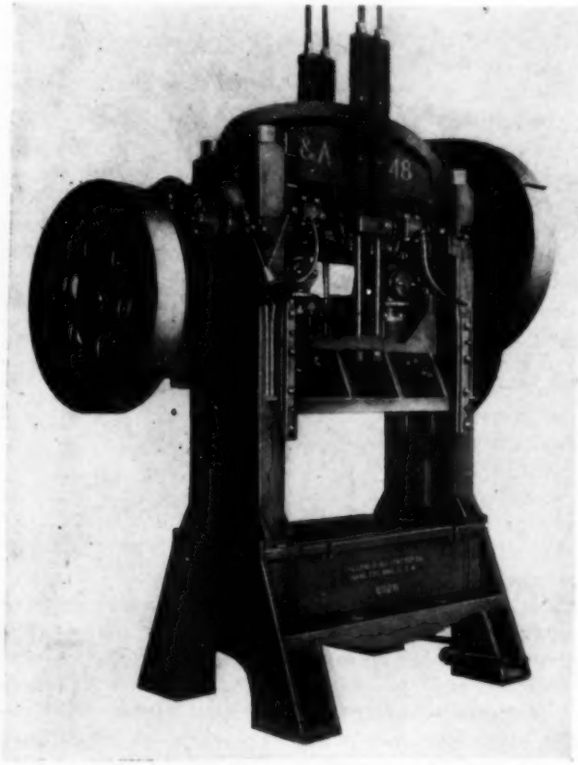


Fig. 1—Front view of Long & Allstatter Straight Side Tie Rod Press

"Dasco" Air-Hardening Tool Steel

An alloy tool steel, cast to shape, or furnished in rolled bars and billets for forging, is being marketed under the trade name "Dasco" by the Detroit Alloy Steel Company, foot of Iron St., Detroit, Mich. This tool steel, when hardened, annealed or normalized after forging, is cooled in still air, which practically eliminates distortions and danger of internal strains and cracking. In cast shape, the tool steel is furnished in many instances at an unusually low total cost, as intricate shapes can be made, leaving only enough material to clean up the casting where finish is required. Tools of this material it is claimed will produce from three to six times the usual number of pieces per dressing.

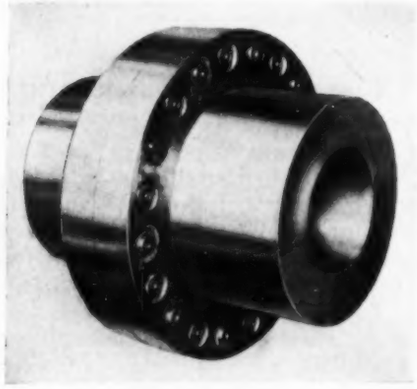
In the annealed condition the tool steel shows a scleroscopic hardness of 36 to 40, is readily machinable, and can be drilled and tapped without difficulty. Castings and bar stock are always furnished in the annealed condition.

Among the products for which the tool steel is recommended are thread gages; plug, ring, and snap gages; lathe centers and mandrels; blanking, forming, drawing, coining, and embossing dies; shear blades and rotary shears; drop forge trimming dies, punches and dies on hot press work, and swaging dies; beading and seaming rolls, spinning rolls, automobile rim rolls and cold rolls; porcelain and brick molding dies; liners for dust mills; blades for dust mill and mixer paddles; and molds in the ceramic industry. In hardening and annealing the material, and also in normalizing it after forging, the cool-

ing is always done in still air to eliminate the possibility of strains and distortions.

Ajax No. 9½ A Heavy-Duty Coupling

A No. 9½ A flexible coupling to transmit 1,200 hp. at 220 r.p.m. has been built by the Ajax Flexible Coupling Company, Westfield, New York. The coupling weighs 2,000 lb. and is

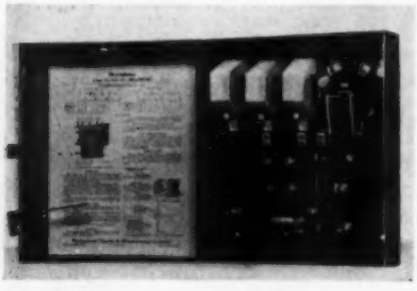


Ajax No. 9½ A Coupling which will transmit 1,200 hp. at 220 rev. per minute

the largest of its size ever built, according to the manufacturer. This type of coupling makes use of pins, bushings, and a rubber bumper.

Westinghouse Class 11-200 Line Starter

Increased safety, economy, and ratings on Class 11-200 line starters are possible by the use of the "Deion" contactors according to the announcement of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The Deion contactor is an effective arc rupturing device and confines, divides, and smothers the arc quickly without the usual flash and attendant scattering of flame. Not only does it provide for greater safety to the operator, but it also permits a smaller enclosure and the consequent decrease in the overall size of the starter. The arc is ruptured so fast and with so little fire that contact and arc chute life are materially increased.



Westinghouse Class 11-200 Line Starter equipped with "Deion" contactors

These Deion contacts are guaranteed to rupture from twelve to sixteen times their normal current carrying capacity at rated voltage under severe operating conditions of low power factor and sustained voltage. During operation the following sequence takes place: The arc resulting from opening the circuit is drawn in air; it is blown into the "deionizing" chamber by a magnetic field; the original arc is broken up into many short arcs; each short arc is magnetically rotated to extinction, and a complete deonization occurs as the line current passes through zero and the circuit is broken.

Newark No. 0 Gear Cutter Sharpening Machine

FOR sharpening formed tooth cutters and gashing cutters, an improved sharpening machine has been placed on the market by the Newark Gear Cutting Machine Company, 69 Prospect St., Newark, N. J. This machine will sharpen cutters from the smallest diameters up to 10 in. The principle employed is practically the same as that used in an older design, one of the outstanding improvements being a fully Timkenized wheel spindle. This spindle is made of high-carbon steel, and is carried on a heavy lever that is pivoted about half way down the base, making it possible for the operator to pass the wheel back and forth across the face of the cutter. His right hand grasps the handle above the spindle. The travel of the wheel inward is governed by the adjustable screw stop, against which the spindle carrying lever contacts. A belt transmits the power to the wheel spindle running at 2,800 r.p.m. The wheel is surrounded by an adjustable guard, to which coolant is fed through a flexible hose by a pump within a tank attached to the rear of the column.

The cutter rests upon a table, which carries a central stud. Different cutter holes are made to fit the stud with adapter bushings. The grinding face of the wheel is adjusted in relation to the center of the cutter by a separate gage, which is applied when setting up. In this way the machine may be set quickly to grind a radial tooth or undercut tooth of any required hook angle. When sharpening this type of cutter, it is often impossible to grind the entire cutting face at one setting, due to a central web. In this case the cutter-holding table is tilted both sides of horizontal, thus enabling the complete cutting edge to be ground. This machine permits heavy pitch cutters to be sharpened without turning the cutter over or changing grinding wheels.

The cutter is indexed from tooth to tooth by the operator, who locates it by means of a spring pawl resting against the back of the tooth being ground. This insures equal

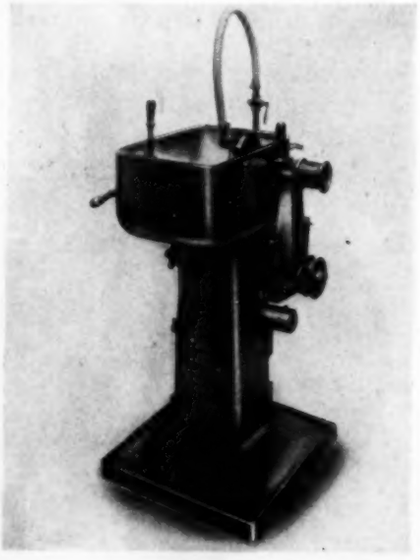


Fig. 1—Front view of a Newark No. 0 Improved Cutter Sharpening Machine

grinding on each tooth, regardless of error of cutter spacing or dial spacing. The indexing finger is equipped with a screw-feed adjustment, which brings more of the cutter into contact with the wheel as sharpening proceeds. This device always keeps the edges of the cutter radial or with the same amount of hooking.

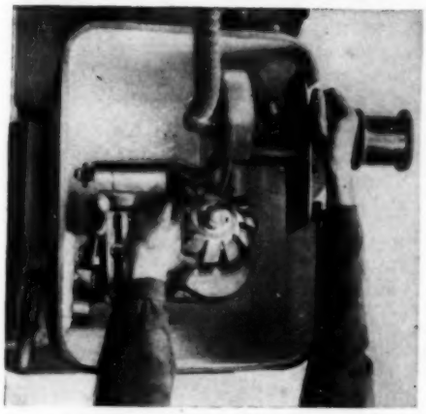


Fig. 2—Showing the method of indexing the wheel and operating the wheel spindle

A pan is cast around the entire machine, making it possible to use large quantities of coolant. The machine is equipped with a diamond and truing device for dressing the grinding wheel. The column is of box construction with cabinet for wheels, bushings and wrenches. The machine requires floor space of 24 by 30 in. and has a net weight of about 925 pounds.

"Workace" Radial Saw

A portable woodworking saw has been developed by J. D. Wallace & Company, 134 S. California Ave., Chicago, Ill. This saw derives its power from an ordinary lighting or power circuit, either d.c. or a.c., the latter of 25 to 60 cycles. It is easily adjusted to cut at any angle for cross-cutting or ripping, dadoing or grooving, rabbeting, routing, panel raising, shaping, sanding, etc. It is also well adapted for straight cut-off work since it travels in a straight line.

"Workace" radial saw

The saw works from above. The motor is built-in and is directly connected. The saw and motor unit are mounted on a turntable 6 in. in diam., which, in turn, is mounted on two heavy steel rods placed 5 in. apart, to prevent any spring. Rods are mounted in a radial arm.

The radial arm is mounted in the pedestal on a turntable 10 in. in diam., permitting the arm to be set in any position. The pedestal is also mounted on a turntable 10 in. in diam. These three turntables enable the machine to be placed in any position for any kind of cutting.

With an 8-in. blade, the machine cuts 2½ in. deep; a 9-in. blade cuts 3 in. deep. The saw travels 19½ in. in the arm and is adjustable vertically 5¾ in. The motor is of the universal type and has ball bearings. Gears reduce the speed to the correct rate for sawing. The saw bearings are of bronze, and lubrication is by automatic force feed. Savings indicated from the use of these saws range from 25 per cent to 50 per cent in time, with considerable saving in investment, operation and maintenance.

"National" Rivet Display Card

A display and sample card for rivets has been prepared by the National Rivet & Manufacturing Company, Milwaukee, Wis. This card is arranged with metal eyelets for easy mounting and has a group of seventeen brass, copper, and aluminum rivets displayed. They are of standard sizes in types suitable for automotive, aeronautical and industrial purposes. This card should be of use as a ready reference in drafting rooms.

Allen-Bradley No. 701 A.C. Contactor

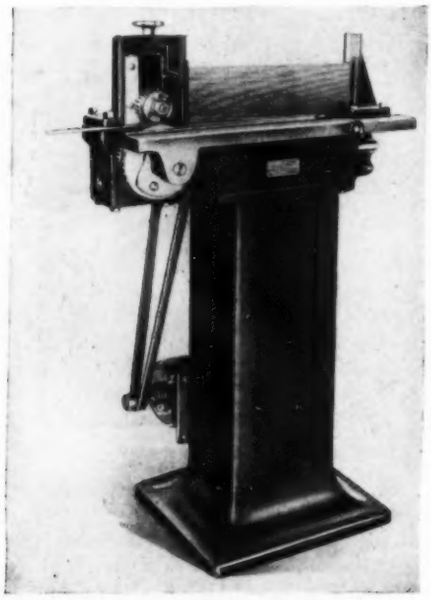
For apparatus requiring an automatic control switch of small capacity the No. 701 contactor has been placed on the market by the Allen-Bradley Company, 286 Greenfield Ave., Milwaukee, Wis. The contactor is provided with aluminum contacts and the entire assembly is mounted on a molded Bakelite base. All switch parts are cadmium plated to prevent corrosion. This switch can be provided for operation on 6, 12, 24, 110, or 220 volts and for any frequency from 25 to 60 cycles. Current ratings range from 15 to 30 amp. Two-wire or three-wire control can be used with any type of pilot control device.

Allen-Bradley No. 701 A.C. Contactor

Noble & Westbrook Rapid-Production Strip Marking Machine

Marking of flat metal strips at the rate of 40 strips per min. can be done on the machine announced by the Noble & Westbrook Manufacturing Company, 20 Westbrook St., East Hartford, Conn. Each strip is marked ten times, thus making 800 separate marks per min. The machine is fed by hand by an operator who can easily keep two machines supplied. The starting lever and feed pins on the machine are all controlled by springs to eliminate damage to the strips in case one should be started wrong.

The marking die used on this unit is made in the form of a roll 2½ in. in diam., on which five trade-marks and five inscriptions are engraved. The feeding mechanism is operated by a cam inclined so that the bottom strip in the magazine is started so that it passes under the die as soon as the preceding strip leaves it. The strips are carried along and marked automatically, and all the operator has to do is keep the machine magazine supplied. The working parts

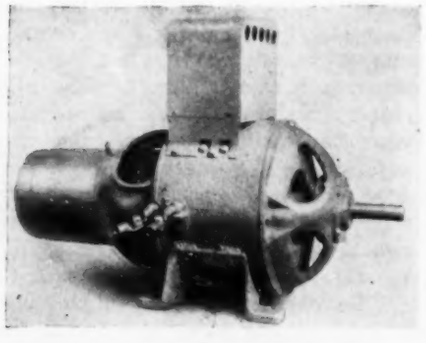


Noble & Westbrook Rapid Marking Machine arranged for the marking of metal strips

are largely inclosed in the main casting, which is mounted on a suitable base. Drive is secured from the ¼-hp. motor through a rack and gear, which run continuously in oil.

Westinghouse Welding Generator

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently added to its line of arc-welding equipment a 200-amp. generator without driving unit.



Westinghouse Welding Generator

This is for use in isolated places where electric power is not available, but where gasoline engines, steam engines, lineshafting, tractors, or similar power units are already at hand.

The complete unit consists of a special constant-current type SK welding generator with coupled exciter overhung from the generator bracket, and a control panel and reactor. The reactor is mounted separately. The overall dimensions of the generator are a minimum so as to permit mounting the generators in the spaces allotted.

The generator is differentially compound-wound and designed for a single operator. The constant-current, variable-voltage characteristics of the generator, together with the separately excited feature, provides a fast, steady and penetrating arc. Variations in arc length or intensity are automatically compensated for by instantaneous changes in the voltage.

The control for the generator is mounted on top of the generator frame and is protected by a sheet-metal cabinet. The control consists of a voltmeter, ammeter, and a single-dial field rheostat for adjusting the welding current over the entire current range.

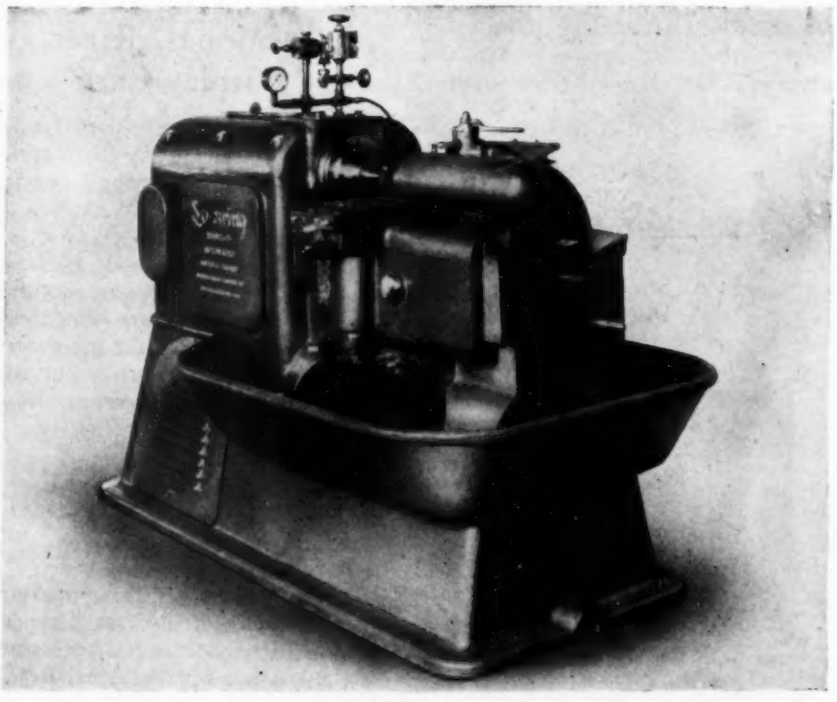
The generator is rated in accordance with N.E.M.A. standards, 1 hour 50 deg. C. rise on a resistance load at 25 volts. The generator has a welding range from 60 to 250 amp. and requires a driving unit whose maximum rating is: motor, 10 hp.; lineshaft, 15 hp.; gas engines, 20 horsepower.

"Lo-swing" Model U Automatic Lathe

ANOTHER automatic lathe has recently been developed by the Seneca Falls Machine Company, Seneca Falls, N. Y. The machine is known as the "Lo-swing" Model U automatic, and has been introduced as a companion machine to the large Lo-swing Model R automatic, described on page 419, Vol. 65, of the *American Machinist*. The Lo-swing Model U automatic is designed to machine the lighter types of steering knuckles, stem pinions, side gears, pistons of both aluminum and cast-iron, and also to do second operation work on various types of larger automotive parts.

When the machine is started, it makes a complete cycle and stops with the carriage slides returned to the starting position. A single lever brings the tailstock center into position and starts the machine in operation. It is necessary, however, to give the lever a distinct and separate movement in order to start the machine. This provision has been made to avoid accidental starting.

When the machine is equipped for individual motor drive, the motor is



"Lo-swing" Model U Automatic Lathe

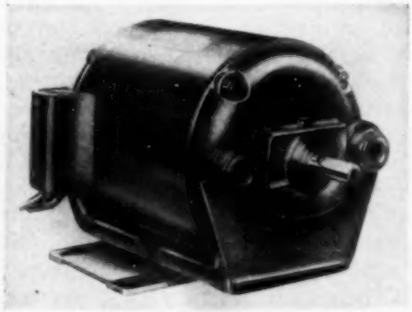
mounted in the base of the machine. Drive is obtainable through belt or silent chain, and is entirely inclosed. Pick-off gears are provided for changing both speeds and feeds. Ball and roller bearings are provided for all shafts, including the main spindle, so that, if desired, the high speeds required by the latest developments in cutting tool materials may be obtained. All the cams, gears and other mechanisms in the head end are automatically lubricated by means of a force-feed pump which floods all moving parts with oil.

The way on which the carriage travels on the bed is equipped with a hardened and ground steel plate, standard on all Lo-swings. The longitudinal and cross-feed movements of the front-carriage slide, as well as the cross-feed movement of the rear forming and squaring slide, are obtained by cams which are hardened and ground.

The machine will take work 5 in. in diameter and 12 in. long. It weighs approximately 5,000 lb., and is so arranged that the automatic loading devices now being developed by the manufacturer may be applied.

Wagner Type RAR Rubber-Mounted Motor

For applications requiring unusually quiet performance, the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., has introduced a type of motor known as the RAR. The motor proper is



Wagner Type RAR Rubber-Mounted Motor

completely insulated from the supporting cradle-shaped base by means of rubber bushings, effecting exceptionally quiet running. Notwithstanding the use of rubber to absorb the slight vibration produced in the motor, the entire outfit is practically rigid and the shaft alignment is in no way endangered. The mounting has been effected without a change in overall length and width dimensions.

The motor is of the brush-lifting type, the brushes being lifted off the commutator as soon as the rotor attains operating speed. This feature insures quietness in operation and prolongs the life of commutator and brushes. High starting and pull-out torque are claimed for the motor, with minimum line disturbance. Although totally inclosed, to prevent the entrance of dust and moisture, and incidentally to muffle windage noises, according to the manufacturer the motor rises less than 40 deg. C. in temperature, under operation.

The motor has also undergone important alterations to improve quietness and electrical performance further. In addition to equipping governor weights with rubber bumpers, as was done previously, the rocker arm has been redesigned practically to eliminate brush noise during starting and stopping. The power factor and efficiency exceed the N.E.M.A. requirement.

Cincinnati Special 96-Inch Openside "Hypro" Planer

ESPECIALLY designed for machining safe doors and frames, a special openside "Hypro" planer to take 96 in. has been developed by the Cincinnati Planer Company, Cincinnati, Ohio. The head of this machine is equipped with special long steel slide, which enables a reach 40 in. below the bottom of the rail. This head is equipped with two means of holding tools. One is the regular clapper box and tool block and the other is by means of a hole in the bottom of the slide that will carry a bar in which the tool can be mounted.

A special rail to support the top of the saddle has been supplied. This gives the rail a third way. The saddle rides on this third way by means of roller bearings. A narrow guide is also provided so as to eliminate all twisting moments. The additional weight of these long slides is taken by a self-contained counterbalance. The standard feed and rapid traverse is supplied to the heads and the hand feed is operated through a special square placed on the top of the slide so that the operator can adjust the tool.

The harp, which carries the slide, is bolted through by means of a T-

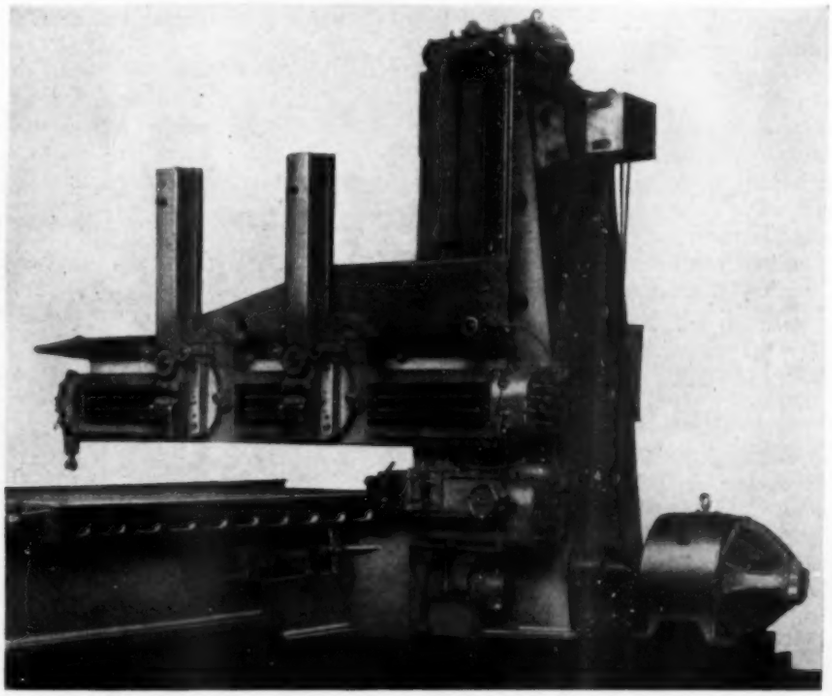


Fig. 1—Cincinnati Special 96-Inch Openside "Hypro" Planer

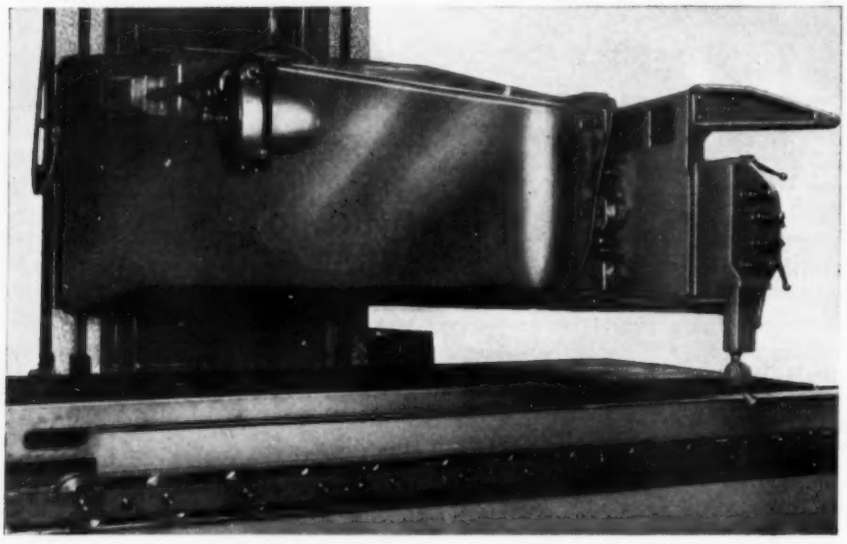


Fig. 2—Back view of the rail showing the torque motor used for clamping the head

slot on top of the saddle in order to assist the operator in swiveling the head. Rack teeth are cut in the harp and a pinion meshes with them so that the crank handle which is used for moving the head can be used for swiveling it also. A supplementary rolling table is supplied so that when machining doors up to 10 ft. square the extreme overhang is supported by means of this unit.

In Fig. 2 is shown the back of the rail. In place of a mechanical device for clamping the rail, a torque motor is supplied, and it is operated by means of push buttons at either side of the machine. By means of this motor, the rail is clamped tighter than is possible by means of a wrench. A safety device has been fitted so that it is impossible to raise or lower the rail while clamped. According to the manufacturer, machining of a certain size door has been reduced from 8 to 5 hours by means of this machine.

"Hicycle" Nut Runners and Grinders

The No. 40-N nut runner, Fig. 1, developed by the Chicago Pneumatic Tool Company, 6 East 44th St., New York City, is one of a line of "Hicycle" portable electric tools now being introduced. The tool is equipped with the "Uniloy" jointless rotor, which operates at high sustained speed, secured by a frequency of 180 cycles. For this type of rotor greater power, speed and torque are claimed together with low maintenance costs, ruggedness, heat resistance and practically no deterioration.

In the nut runner all revolving parts are suspended on ball bearings, as the cross-section, Fig. 2, shows. Bolt and stud construction is used for housing, gear case and switch handle. A cushion clutch with automatic release takes the shock of impact from operator and tool. When the nut is driven to desired tension the clutch automatically releases. A positive make-and-break switch is employed for electrical contact, and a reversible

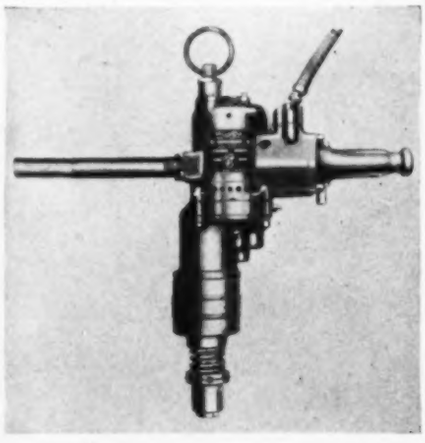


Fig. 1—"Hicycle" Nut Runner

switch is obtainable at additional cost.

The tool comes in four sizes for nuts on bolts $\frac{3}{8}$, $\frac{7}{16}$, $\frac{1}{2}$ and $\frac{5}{8}$ in. in diam., on which the loaded speed is, respectively, 1,025, 650, 450, and 250 r.p.m. For all these sizes the minimum distance from housing to center of spindle is $1\frac{5}{16}$ in, over-all length from top of spade handle to end of chuck is 18 in., and net weight is 18 lb. The $\frac{7}{16}$ in. hexagonal shanks are standard for socket wrenches. Equipment supplied includes 25 ft. of four-conductor cable, with provision

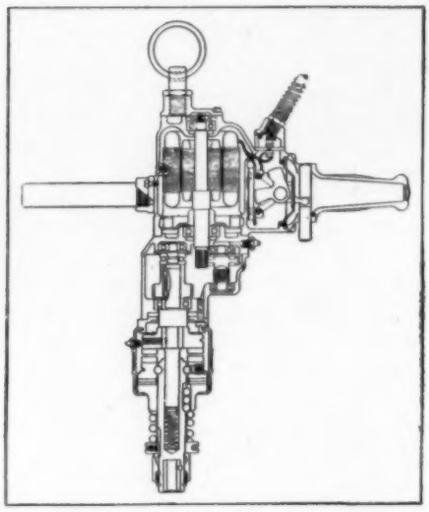


Fig. 2—Cross-section of the Nut Runner

Fig. 3—"Hicycle" Grinder

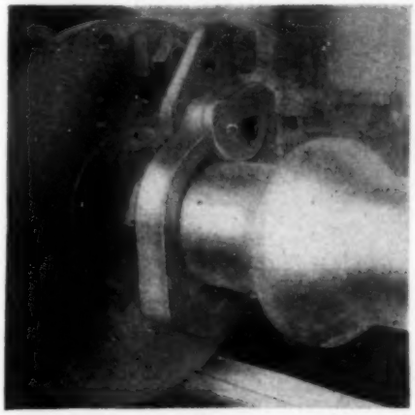
for grounding, and one socket wrench.

Features of the tool are: Removable vertical suspension ring, with boss to hold an eyebolt for horizontal suspension; removable rotor shaft; Zerk fittings for lubrication; quick adjustment for various classes of work; malleable iron gear case and transfer plate; and knock-out plugs to facilitate removal of bearings.

Another "Hicycle" tool now being marketed is a grinder. The No. 60 grinder is shown in Fig. 3. It takes a 6-in. wheel, operating vertically. The No. 66 grinder takes a 6-in. hard wheel, operating horizontally. Other tools are: Drills, reamers, screw drivers, tappers, buffers, sanders, and stud setters.

Peacock Lathe Dog

The lathe dog shown in the illustration is being marketed by Peacock & Son, 913 Collings Ave., West Collingswood, N. J. It is designed upon the cam grip principle, where the



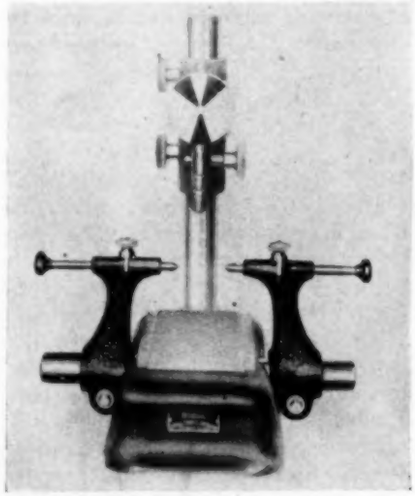
Peacock Cam-Operated Lathe Dog

more force that is applied to the part held, the tighter the cam pinches. The dog proper is an elliptical-shaped steel casting, with a boss at one end which acts as a bearing for a shaft that carries a heart-shaped cam on one end and a driving arm on the other. This driving arm engages an angle or pin on the faceplate and the resistance against the cutting tool determines the grip of the cam on the piece being cut.

The dogs are made in ten sizes, 1½ and 2 in., and in increments of an inch up to 14 inches. The throw of the cam is sufficient to take diameters in between the sizes given.

Federal Direct-Reading Comparator

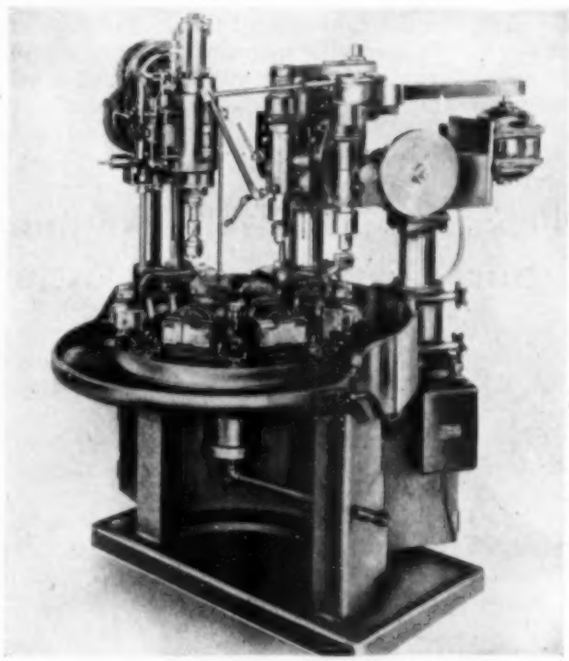
Graduations on the direct-reading comparator announced by the Federal Products Corporation, Providence, R. I., are 1/10 in. apart, equalling a measurement of 0.001 in. The device has means for coarse and fine adjustment on the head and will take objects up to 8 in. in diam. underneath the stem of the dial gage. The platen of the device has an area of 4¾x6 in., the longest dimension being toward the post. The comparator may be furnished with V-blocks having hardened and ground rollers 7½ in. long, and held by heavy supporting brackets carried on a shaft passed through a hole in the base. Centers also in brackets may be had. The weight of the comparator without the blocks is 17 pounds.



Federal Direct-Reading Comparator

Stecher Multiple-Unit Automatic Drilling and Tapping Machine

PRODUCTION of 10,000 pieces per day is quoted for the automatic drilling and tapping machine developed by the Charles Stecher Company, 2452 Greenview Ave., Chicago, Ill. This machine is an all-electric, full-automatic type for performing drilling and tapping operations. The unit illustrated was developed for drilling, tapping and finishing small brass L's to be used in the automotive industry. According to the manufacturer, this machine can be adapted to drilling and tapping almost any kind of small parts. A reversing motor is used for reversing the tapping head and this action takes place 50 times per minute. Because of the large amount of heat generated by this continuous reversing, compressed air at 5 lb. per sq.in. is ordinarily blown through the shields of the three-phase, high-torque, high-resistance, squirrel-cage induction motor. By this means the temperature of the motor is kept below 160 deg. F. In the illustration the end shields on the motor at the left have been left off. The table has a large trough for catching coolant.



Stecher Multiple-Unit Automatic Drilling and Tapping Machine

The cycle is as follows, a cam operates a start button which closes one side of a magnetic reversing switch; this starts the motor driving the tapping head down; when the threading is completed, a cam trips a reversing button, which reverses the motor and backs off the threaded piece, and at the top of its travel, a limit switch opens the motor control circuit and allows a solenoid brake to stop the motor within three revolutions. This cycle is repeated at each indexing of the table or 24 times per min. The drilling heads use standard 3-phase, normal - torque, normal - reactance, squirrel-cage, induction motors rated 1½ hp. at 1,800 r.p.m. They are equipped with ball-bearings and mounted in a vertical position. The finished works drops automatically into a tray.

Roller-Smith Type FD Pyrometer

For checking the temperature of molten white metals, the type FD pyrometer has been placed on the market by the Roller-Smith Company, 233 Broadway, New York, N. Y.

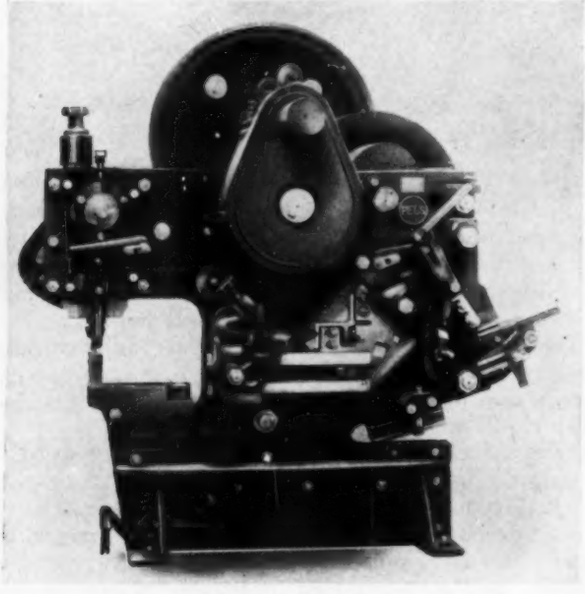
Roller-Smith Type FD Pyrometer

Especially in the casting of babbitt bearings, it is necessary to maintain the proper temperature, since with too low temperature the castings are apt to be imperfect owing to the failure of the metal to flow to all parts of the bearing, and if too high, porosity is bound to result.

The type FD pyrometer is mounted upon a support in plain view of the operator. The thermo-couple element is incased in a heavy iron cylinder and the scale is legible at a distance of 12 ft. The instrument consists of a sturdy D'Arsonval type millivoltmeter, calibrated to read temperature degrees from 0 to 1,200 deg. F. It is marked at 20 deg. divisions. The instrument case is finished in black rubberoid, baked-on enamel. The instrument is automatically compensated for changes in temperature by means of a thermostatically-operated magnetic shunt operating on the instrument magnet. The instrument is equipped with a mounting clamp, by which it may be fastened against a vertical iron pipe or conduit in order to prevent damage.

Pels Type ME-10 Combination Punch, Shear, Angle and Bar Cutter and Coper

PUNCH and shear speeds of 40 strokes per min. are featured in the No. ME-10 quadruple, combined, universal punch and shear with built-in coper recently added to the line handled by Henry Pels & Company, 90 West St., New York, N. Y. This unit is the smallest of type ME machines yet developed, but in general it has all of the features and characteristics of sturdy construction as for the Nos. 13 and 16 units, described on page 1022, Vol. 69, of the *American Machinist*. As in the larger machines, the frame is made of heavy rolled steel plate guaranteed to be unbreakable for the service intended. The flywheel runs in long bearings supplied with lubricant by ring oilers. All gears have cut teeth. Bronze bushings are used throughout. The motor at the top drives through a belt equipped with an idler pulley so that it maintains the power transmitted at a constant amount. Easy centering of the punch in a prick-punch mark can be done because of the fact that at each rotation of the crank the punch is lifted from the material through an adjustable amount in order that the piece can be shifted until the point on the punch mates with the center hole. After this is achieved, the clutch is engaged by a convenient handle. Holes, 1 x $\frac{3}{8}$ or $\frac{3}{4}$ x $\frac{1}{2}$ in. can be punched. Throat depth is 12 in. and holes can be punched in flanges of 3- to 9-in. beams and in the webs of 3- to 14-in. beams and 3- to 10-in. channels.



Pels Type ME-10, Quadruple, Universal Punch and Shear with Built-in Coper

Coper, angle and bar cutter, and slitting shear are located at the opposite end of the machine. Splitting plates up to $\frac{3}{8}$ in. thick in any width and length can be done, although trimming up to $\frac{1}{2}$-in. plates is ordinarily the only operation performed. The length of the shear blades is $8\frac{3}{4}$ in. Several openings are provided for cutting round and square bars, the maximum square being $1\frac{3}{8}$ in. and the maximum round $1\frac{1}{2}$ in. Very little flattening of rounds occurs because of the long bearing area through the frame. The angle cutter can also be arranged for cutting T's by shifting a plate after unbolting two screws. Angles or T's can be cut off up to 3 x 3 x $\frac{3}{8}$ in. on straight cuts, and mitre cuts on $2\frac{1}{2}$ x $2\frac{1}{2}$ x $\frac{1}{4}$ angles can be made. The coper will make rectangular slots 2 in. wide by $3\frac{3}{8}$ in. deep in $\frac{1}{4}$-in. stock. Cuts can be duplicated indefinitely. The machine requires $2\frac{1}{2}$ hp. for belt drive and 3 hp. for direct drive. It is 55 in. in overall length, 36 in. in width, and 50 in. high. The weight is 2,550 pounds.

"Handnib" No. A-5 Combination Drill Rod Cutter and Nibbler

Cutting drill rod and both inside and outside nibbling can be done on the model A-5 bench type unit announced by the National Machine Tool Company, Racine, Wis. This unit is similar to that announced on page 754, Vol. 68, of the *American Machinist*. The device will cut a $\frac{3}{8}$-in. drill rod without distortion. It is also suitable for cutting templates from sheet metal, and also for cutting trial blanks for metal stamping work, thus saving costly bench work. For inside nibbling, one hole is drilled and then the machine is used to nibble out the desired shape. Blades for inside and outside nibbling may be interchanged readily by simply removing two small screws. The capacity in this sort of work is $\frac{1}{8}$-in. flat stock and the depth of cut-

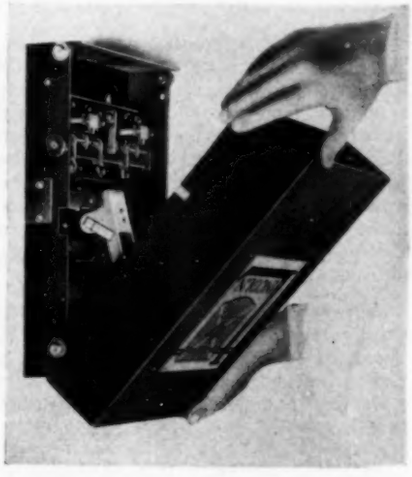
"Handnib" No. A-5 Combination Drill Rod Cutter and Nibbler

ting is 3 in. from any outside edge. The nibbling blade furnished is ¼ in. thick. The device may be mounted in a vise as shown, or on a bench by means of screws through the angle plate riveted to the main frame.

Lincoln Safety-Type Across-the-Line Starter

Ease of installation, accessibility to all operating parts, and sturdy construction are some of the advantages of the across-the-line starter announced by the Lincoln Electric Company, Cleveland, Ohio. Installation of this unit is simple, only four screws being required to hold it in place. Releasing two other screws permits the contractor panel to swing out, thus making the lead contact accessible. A cover of the drop-hinge type incloses the entire mechanism and permits installation of starters in close-spaced groups.

The starter, which is controlled by a push button, is equipped with contact points so designed that wiping action prevents pitting. The cadmium-plated steel shields provide an instantaneous thermal and magnetic quench for the arc. Arc chimneys are of heavy pressed magnesite. The relay armature has a cushion action which reduces wear and insures long life. It is provided with replaceable bronze bearings, and is actuated by a coil spring. A safety feature is that the red stop button encircles and protects the green start button so that it is impossible to close the starting circuit unintentionally.



Lincoln Across-the-Line Starter with push button safety switch

Davis & Thompson Horizontal Multi-Spindle Drilling Machine

ADAPTED to drilling push rod guides for automobile motors, the drilling machine illustrated has been placed on the market by the Davis & Thompson Company, 57th Ave. & Mitchell St., Milwaukee, Wis. This machine drills from one side and reams from the opposite. The heads are fed by a cam located in the housing. One of the features of this machine is shown in Fig. 2. In this view the drill spindles are shown very close together and driven by means of cranks, since it was impossible to drive each spindle by means of gearing because of the small space allowed. The second spindle from the top has a gear mounted on a crank driving the drill and there is also other gearing for the second spindle from the bottom. Six cranks are driven by these gears through a connecting rod which connects all the cranks together. Since there is a considerable thrust on the drills, and because of the small amount of room, the thrusts are taken on rings or collars turned on the drill spindles.

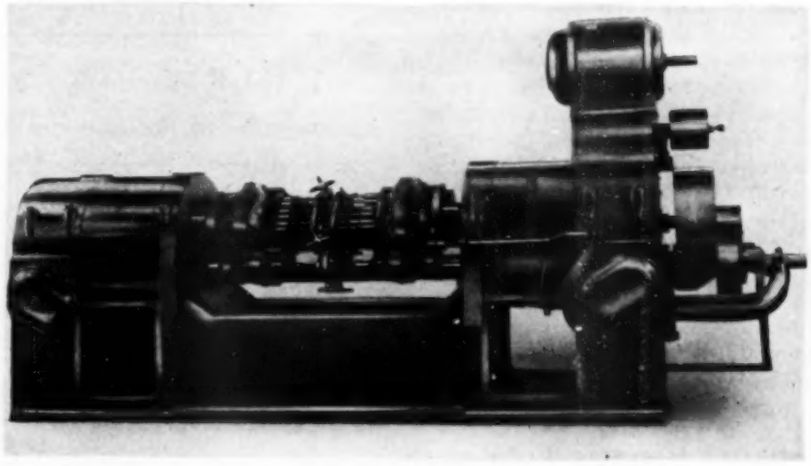


Fig. 1—Front view of the Davis & Thompson Horizontal Multi-Spindle Drilling Machine

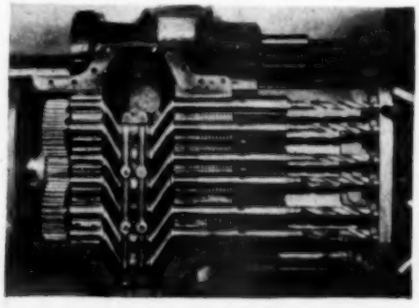
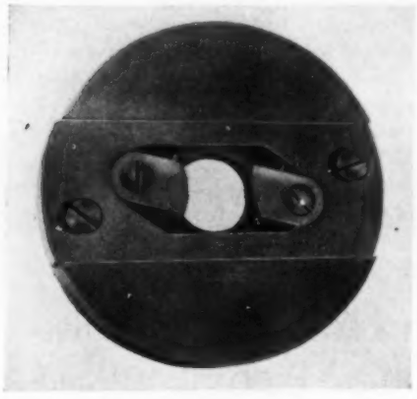


Fig. 2—View of the arrangement of the spindles which are driven by cranks from a connecting rod driven in turn by the top and bottom gears

Seneca Falls Automatic Work Driver

The automatic work driver supplied for the past two years only to users of "Lo-swing" lathes is now being offered for general sale by the Seneca Falls Machine Company,



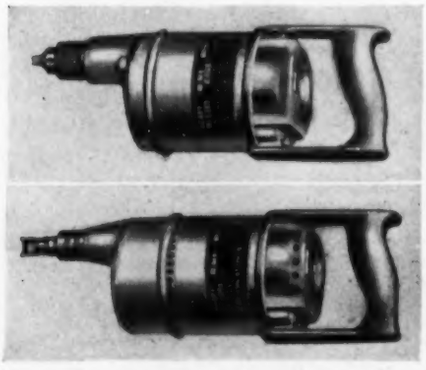
Seneca Falls Automatic Work Driver

Seneca Falls, N. Y. The chief feature of this patented device is that it eliminates the necessity for dogging work.

The driver may be applied to any machine by the use of a chuck plate similar to that used in applying standard chucks to lathes. The work is gripped by means of two corrugated jaws, the corrugated surface being somewhat eccentric to the pivoting point. These jaws are mounted in a slide which is free to float in a transverse guide in the driver-head, so that, regardless of whether or not the work is properly centered, there is no danger of putting an excessive amount of pressure on the head center.

Schauer Electric Drill and Screw Driver

In both the type L1½U, ¼-in. drill and the positive-clutch type screw driver, a powerful air-cooled motor is employed. These tools have been placed on the market by the Schauer Machine Company, successors to the Neal & Smith Electric Tool Company, 905 Broadway, Cincinnati, Ohio. The drill at the top of the accompanying illustration is of the offset, close-quarter type, the motor being equipped with ball bearings. Ball thrust bearings are used on the chuck. The gears, pinions, and studs are of steel, heat-treated and operating in grease, the studs being supported at the top and bottom. The handle and cover cap are removable without disturbing the bearings, switch, or electrical connections, thus permitting inspection while the motor is running. The approximate speed at load is 1,400 r.p.m. The length is 11 in., and the approximate weight is 6 pounds.



Almost identical construction is employed for the Schauer ¼-Inch Drill and the Screwdriver illustrated at top and bottom respectively

The positive clutch-type electric screwdriver, illustrated in the lower half of the accompanying illustration, is similar to the drill previously mentioned, is light in weight, and is of the offset, close-quarter type. It is equipped with the same motor as the drill.

The illustration shows the finder, which is standard on all sizes, cut away to show the bit, which remains stationary until the clutch is engaged by a light pressure. A feature of this tool is that no moving parts are exposed to mar the work in case of slipping or close-quarter operation. This tool can be supplied with a socket for nut tightening. It is made in three models for Nos. 10, 14 and 20 screws, operating at 400, 250, and 200 r.p.m., respectively. The weights of these three models are 6½, 7, and 12 lb., and the lengths are 12¾, 12¾ and 15 inches.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

A patent, 1,708,977, on an electric welding machine, assigned to the Stanley Steel Welded Corporation, covers a machine with expansible electrodes for holding and butt welding the hub sections of automotive wheels.

In a turret lathe patented, 1,709,118, and assigned to the Gisholt Machine Co., a manually-operated clutch-operating lever is provided and has a lock holding it in the clutch-engaging position. It also includes a rapid traverse of the tool-carrying slide.

A polishing machine patented, 1,709,171, and assigned to Steel and Tubes, Inc., has two tensioned polishing belts passing around pairs of pulleys and a pairs of cradles supporting the work to be pressed upward against the belts.

Cincinnati Grinders Incorporated was assigned patent 1,709,348 on a centerless grinding machine having a regulating support which moves at low speed and presents a peripheral surface having lines of operating contact with the work, the tangents of the surface passing through the lines from 0 to 90 deg. to the vertical.

An electric tube-welding machine was patented, 1,709,587, by John F. Lawson of Toronto, Canada. It has a combination of feed rollers, roller electrodes, and a seam spreader between the feed rollers.

A centerless grinding machine patent, 1,709,818, was assigned to Cincinnati Grinders Incorporated. It covers a machine with opposed grinding and regulating wheels, the latter having a work-controlling portion engaging and urging the work piece toward the grinding wheel.

Parts and Mechanisms

A bearing, patented 1,708,997, by Harry H. Avery, of Lethbridge, Canada, has recesses which contain a lubricating material having a melting point just above the normal running temperature of the bearing.

A chromium plating tank, patented, 1,709,022, and assigned to United Chromium, Inc., is of metal with glass sheets covering the inside to cut off stray currents.

A gear-hobber control was patented, 1,707,546, and assigned to Gould & Eberhardt. It comprises a transmission extending from one spindle to the other for establishing the speed ratio between them, a transmission for sliding the head, a means for quick traverse of the head, and a trip mechanism for automatic disconnecting the clutch when the head has carried the hob through the blank.

A reversing automatic hand wrench was patented, 1,704,067, by John S. Wick, of Long Beach, Calif. It has a right- and left-hand screw shank and a driving nut with teeth for engaging in the spiral.

A ratchet screw driver operated by two heavy coil springs was patented, 1,704,062, and assigned to the L. G. S. Devices Corporation.

News of the Week

Arbitration Tribunals Inaugurated

The American Arbitration Association, 521 Fifth Ave., New York, formally opened its National System of Tribunals in 1,650 cities and towns of the country a few weeks ago. Commenting on this event President Hoover wrote the Association: "Arbitration of commercial disputes in place of avoidable litigation increases business efficiency by promoting good-will and mutual confidence. Expeditious, regular settlement of business controversies within industry itself, by its own experts, is fundamental, but machinery is needed to make it effective. The American Arbitration Association provides a practical mechanism through which the method can be applied."

It is the object of the several tribunals to settle business controversies by submission of issues to expert business judgment. The award of the arbitrators will possess the legal finality of a court decision. At first there was a reluctance of the courts to recognize this new method of settling disputes, but after several separate attempts at establishing an enforceable system of arbitration had been made in several states the movement so developed that it was finally taken up by the federal government and incorporated in a statute known as the Federal Arbitration Act.

Propose New Measurement of Bolt Lengths

At a meeting of the Bolt, Nut and Rivet Manufacturers Association, held in Washington, D. C., on May 23, the following resolution was unanimously adopted: That the measurement of the length of all bolts be made from the largest diameter of the bearing surface under the head to the extreme end of the point. This means that in the case of countersunk head, deck and elevator bolts the overall dimension prevails.

Sessions for Business Executives at Harvard

Another special session for business executives will be held this summer from July 1 to August 10 at the Harvard Business School, Cambridge, Mass. At the first session, held last summer, 180 men from 95 companies attended. The idea back of the special session is to make the staff, the facilities and the research work of the Harvard Business School directly available to men holding responsible positions in business. Six different groups of courses are to be offered this summer: Interpretation of Financial Statements, Public Utilities, Management and Economics, Railway Transportation, Bank and Trust Management, Sales Management and Retail Distribution. Enrollment in each course is limited to a small number so that general discussion by different individuals can take place each day when some current business problem is presented.

Research Fellowship at General Electric Co.

In honor of Thomas A. Edison and in commemoration of the 50th anniversary of his incandescent lamp, an Edison Fellowship for Research in the General Electric research laboratory at Schenectady, N. Y., has been established. Its object is to help determine the fitness of the Fellow for industrial or scientific research by arranging for a year's research in that laboratory. The opportunity will be given to the selected candidate who has adequate training and who has done sufficient original work to have indicated an aptitude for research. The year's fellowship carries a grant of $3,000. The selection from applicants will be made by the National Research Council with the advice of the Director of Research of General Electric Co., and the choice of research work will be influenced by the preference of the individual.

Any research man wishing to apply for the fellowship should send to the Director of the Research Laboratory, General Electric Company, Schenectady, N. Y., before July 4, relevant information about his training and a recent photograph, and should arrange for a separate letter of recommendation to be forwarded by someone with whom he has done original scientific work.

Westinghouse Now Has Night Welding School

The increased interest and demand for practical instructions in electric arc welding have made it necessary for the Westinghouse Electric & Manufacturing Co. to conduct night classes in practical arc welding instructions. The course is open to anyone desiring arc welding training, who may be conveniently located for attending this school. A small tuition fee is charged for the three months course. The classes consist of two groups of students, each group meeting two nights a week for three hours each night for a period of three months. A competent arc welding instructor is in charge of these classes. The enrollment is limited so that the students may receive individual attention and instruction.

Such classes are also conducted in the day welding school, which is equipped with the latest design of arc welding apparatus. The regular day school is open to buyers or prospective buyers of arc welding equipment for special instructions without charge.

Cast Iron Production Still High

According to a report issued by the Gray Iron Institute, the index of production of cast iron during April for 102 foundries reporting was 133.1, as against 135.4 for March. The base figure is average monthly production during the last three calendar years. The index of unfilled orders stood at 174.4, as against 118.1 in March, indicating a large increase in the backlog of orders. Material on hand declined from the index figure of 175 in March to 166 in April.

Bicycle Production Gains in Canada in 1928

Production from the bicycle industry in Canada during 1928 reached a new high level with the selling value of products 52 per cent over the previous record established in 1926 and 85 per cent better than 1927. The comparative figures furnished by the Dominion Bureau of Statistics in a recent report on the industry are: 1928, $2,213,493; 1927, $1,194,471; 1926, $1,453,658.

Implement Companies Plan Mergers

Plans for a $50,000,000 merger of agricultural implement companies were disclosed recently by W. A. Munsell, president of Mitchell, Lewis & Staver, a farm implement firm of Spokane, Wash., and Portland, Oregon. The project would merge the Oliver Chilled Plow Works, of South Bend, Ind.; the Hart-Parr Tractor Co., of Charles City, Iowa; Nichols-Shepard, of Battle Creek, Mich.; and the American Seeding Machinery Co., Springfield, Ohio. According to Mr. Munsell, the name of the merged concern would be the Oliver Farm Equipment Company.

Three new units have joined the $125,000,000 United Tractor & Equipment Corporation, co-operative farm implement and industrial equipment company. The new members are the Maine Steel Products Co., of Portland, Me., maker of snow plows; I. B. Rowell Co., of Waukesha, Wis., manufacturer of feed mills, ensilage cutters and silo fillers, and the Northwestern Manufacturing Co. of Milwaukee, maker of portable electric arc welding equipment.

Exports of American Industrial Machinery Show Continued Growth in 1928

DOMESTIC exports of American industrial machinery for 1928 again showed a substantial gain over the previous year, continuing their growth of the last six years, R. G. Matthews, Assistant Chief, Industrial Machinery Division of the Department of Commerce, states in a recent report. Exports since 1922 have increased almost 100 per cent. Furthermore, they were practically two and one-half times the pre-war figures for 1913, and only failed to reach the volume attained in 1921, the last year of the post-war boom, by a little over two million dollars.

Exports totaled $206,312,000 last year, a $23,000,000 gain over the $183,169,000 worth shipped abroad in 1927 and a steady rise from the $123,598,000 figure of 1923.

In view of the constantly increasing competition from Great Britain and Germany, this is a striking tribute to American manufacturers of industrial machinery, and shows that whereas foreign competitors have been selling on a price basis, American manufacturers have been selling on a quality basis and have been changing designs to keep pace with the times and the greater industrialization in America.

Whether this advance in exports can be continued indefinitely, Mr. Matthews finds it hard to predict. There is, however, a constantly growing desire abroad to learn more about American methods of production. This means that most of the machinery manufactured abroad, except for general purposes, will not play any important part in the general American outlook. For example, foreign manufacturers of automobiles are realizing that without new and up-to-date equipment similar to that used in this country, it is impossible for them to compete with the American manufactured cars in their own markets, even with their lower labor costs. Consequently they are very much interested in all our improvements along this line.

Other outstanding developments are those in the steel industry, including some of the new welding processes, and in the rayon industry and other kindred lines. All of these new designs and the quality of American equipment have helped to sell it in the face of foreign competition, and have made it possible for the American manufacturer to increase his exports.

Canada ranks first as a market for industrial machinery with a total absorption value in 1928 of $49,221,231, with the United Kingdom next with less than half this amount, and Mexico third, the amount exported to that country being about $10,000,000. France now occupies fourth place in the American scheme of machinery exports, in spite of the fact that it has been taking a large quantity of German machinery and equipment on reparations account. The latter is a type of competition peculiarly difficult to meet since in many cases a customer who is willing to take German equipment and machinery is allowed by the French Government to buy at a price less than the actual German selling price, the French Government taking the difference or a loss on their own account. Furthermore, the manufacturer is allowed unusual terms of credit.

Another country which has shown a startling rise in its consumption of American machinery and equipment is Soviet Russia in Europe. This country now ranks sixth among American machinery markets.

Cuba, one of the most important outlets for American machinery, fell from fourth to twelfth place in 1928. This has been largely due to the fact that the purchase of sugar machinery declined considerably during the past year. The manufacturers of the other countries, with the possible exception of the Philippine Islands, kept about their same relative positions in their buying. The Philippines, however, showed a very gratifying increase in the consumption of American machinery and equipment, and there is every reason to suppose that this increase will be continued as the country becomes more and more industrialized.

The largest specific class of industrial machinery exported in 1928 comprised the mining, oil well and pumping machinery group, with a total value of $35,691,000. This was closely followed by the metal-working machinery shipments which were valued at $34,125,000. Other important classes were construction and conveying machinery, $22,791,000; textile sewing (industrial) and shoe machinery, $18,847,000; and power generating machinery, except electrical and automotive, $14,631,000. Miscellaneous machinery exports which include a numerous list of items not separately classified reached a total of $80,127,000.

In the mining, oil well and pumping machinery group, Canada, Venezuela, Mexico, the Netherland East Indies and Argentina took the largest amounts. However, the United Kingdom, Chile, British South Africa, British India, Colombia and Soviet Russia in Europe, also imported fair quantities.

In the metal-working machinery group, the following were the leading markets in the order of their importance: Canada, Great Britain, France, Germany, Soviet Russia in Europe, Japan and the Irish Free State. In the group comprising construction and conveying equipment, Canada was by far the largest importer, with Soviet Russia in Europe, next, followed by Brazil, Argentina, Mexico and Cuba. Canada, however, purchased more of this type of machinery than all the other countries mentioned combined, although a considerable quanity of construction and conveying equipment is now being manufactured by Canada itself.

Latin America Assuming Greater Importance as Market for Industrial Machinery

By Paul Wooton

Washington Correspondent, American Machinist

WITH American industrial machinery moving into export at the rate of $1,000,000 worth a day the Department of Commerce is bending every effort to lend assistance in keeping up this increase. It is recognized at the Department that Latin America, now our most important market for such products, has the very greatest potentialities.

The principal reason given for expecting continued increases in the demand for machinery in Latin America is the fact that it is incorporating its industrial activities and putting them on a much better business basis than ever before. The corporation is supplanting family ownership in industrial undertakings. Business is being conducted on a larger scale and resort is being had to all forms of modern equipment.

One of the effects of this evolution is to centralize more of the population in cities and towns. This, in itself, makes necessary other equipment which goes with supplying centers of population with modern facilities. The extent to which this movement is under way may be judged from the fact that the total amount of manufactured goods in Chile increased 161 per cent betwen 1912 and 1925, the last year for which production statistics are available. Official figures for 1926, however, show that of 3,000 industrial companies only 80 are listed on the stock exchange, but those 80 are employing one-third of the capital being used in manufacturing activities.

While Latin America is embarking in many types of manufacture, it has no plans for the making of its own machinery and probably will continue to be an importer for many years to come of that type of manufactured product.

The principal kinds of machinery moving into Latin America are those used in mining, in road construction, in construction and excavation, in the generation of power and for the manufacture of metals, textiles and shoes.

Mexico continues to be the largest purchaser of American machinery. In 1928 its purchases exceeded $10,000,000. If political conditions there give any promise of becoming more stable, it is recognized that there will be a sharp

upturn in the demand from that country.

Argentina in 1928 ranked second among the countries of Latin America as a purchaser of American machinery. The value of these purchases was $8,522,463. Its purchases were scattered throughout the entire list, but the fact that it is buying boilers and internal combustion engines is the best indication that the country is continuing to build industrial plants. It also is a large buyer of construction and conveying machinery. Argentina is going into the winter with good prospects and its machinery purchases are expected to increase.

Venezuela occupies third place, due almost entirely to imports of oil-well machinery. There has been some slackening in the activities of the oil producers in that country, with indications pointing to a decline rather than an increase in the volume of imports. The wealth, however, that is being created from the production of oil is finding its way into local industrial enterprises with prospects favoring purchases of larger amounts of other types of machinery.

Brazil bought $5,391,267 worth of American machinery in 1928 but economic conditions in that country are somewhat depressed with indications pointing to smaller purchases this year.

Cuban Market Depressed

Cuban business is passing through a very uncertain period. The prospect of tariff revision in the United States began affecting business late in 1928. This has become a depressing factor of increasing importance since. The sugar situation has not been conducive to the purchase of any but the most necessary sugar mill machinery for the past three years. The general uncertainty has been reflected in other activities making use of machinery, with the result that purchases which exceeded $11,000,000 in 1925, fell to $5,160,000 in 1928. In that connection it may be mentioned that the Philippines apparently are destined to profit at Cuba's expense. This is reflected in the statistics for 1928 which show that the Philippines took nearly as much American machinery as did Cuba. This is expected to turn up sharply in 1929, particularly if an increase in the duty on sugar should become effective. In Colombia, machinery purchases have been holding their own with no marked increase over 1927 or 1926. No material changes in the situation are expected during 1929.

While Chile's purchases of machinery in 1928 were less than in recent years, there is no country in South America that has greater promise of registering marked increase in its machinery purchases.

Peru purchased $2,280,962 worth of machinery in 1928. An increase in 1929 is expected. Purchases of machinery in Panama are increasing rapidly and amounted to nearly a million and a quarter of dollars in 1928. Bolivia and Uruguay fell just under the million mark that year. Equador's purchases, totaling $575,204, show an increase of more than 50 per cent over the rate of purchases in 1927, 1926 and 1925. The small countries of Salvador and Honduras between them took nearly a million dollars worth of American machinery. Guatemala's 1928 purchases were $328,191; those of Haiti $273,193; those of Nicaragua $267,566, while Porto Rico bought $266,602 worth of American machinery.

French Automotive Situation Improves

By Our Paris Correspondent

There are rumors in automobile circles of combinations and working arrangements tending to reduce the number of competing models, but nothing definite is heard here of any infiltration of American firms in the French market in connection with existing French firms. The Rosengart 5-hp. car is announcing in its advertisements that 150,000 units are actually in service, but it seems inconceivable, given European production methods what they are in general, that this firm could have turned out so many since the first cars were shown at the show of last November.

The French industry apparently fears the new German competition in automobiles as in many other items, citing the fact that the General Motors policy already manifested in the new Opel models has brought about a reduction in price equivalent to 2,700 francs, comparing the vehicle in question to the best known similar French *marque*. If this position is maintained the French manfacturer will either have to produce more cars or cut costs in some way which up to now has not succeeded in bringing French prices for the equivalent car down to those of other competing countries.

Contrary to the growing practice of decentralizing industries away from the Paris district, the Renault firm is building a new plant on an island in the Seine just below Paris. Installation and equipment will meet the most modern demands, with a complete system of conveyor assembly lines which, in the present plant, have been but partial. With the Billancourt plant of today and the new plant, production can be pushed to 500 cars per day.

Gain in Truck Production

The production of industrial motor vehicles has greatly increased in France, those in actual service numbering 31 per cent of the total automobile registration, as against 29 per cent in Great Britain and 12 per cent in the United States. It is in this branch of the motor industry that the greatest growing need of machine equipment on modern lines is shown. Experts believe a still greater future for motor transport is coming because of the very complete network of national and departmental highways. The cost per ton mile for freight so carried is rather less than four cents. Railways are already feeling the pressure.

To Study Heavy-Duty Anti-Friction Bearings

A Special Research Committee on Heavy-Duty Anti-Friction Bearings of the A.S.M.E., which was recently organized, held its first meeting on May 21 at the Carnegie Institute of Technology, Pittsburgh, Pa. This committee was particularly formed to study the use of heavy-duty anti-friction bearings in rolling mills and the problems that have arisen from their use. The scope of the investigation will include the collecting of existing data on loads and the securing of additional information where existing data is deficient, and an investigation into the relation between speed and load on the bearing and its life. One of the first steps will be the preparation and publication of a bibliography on heavy-duty anti-friction bearings.

Aeronautic Notes

The Atlanta Aircraft Corporation, incorporated in Atlanta, Ga., recently with $300,000 capital, elected Robert Gregg, head of the Atlantic Steel Co., president of the new corporation at a meeting of the stockholders and directors. The company has a site at Candler field and will start immediately construction of a plant to manufacture a tri-motored, all-metal monoplane. The initial unit, which will be ready this summer, will have a capacity of one plane per week, other units to be added before the end of this year.

The Curtiss-Caproni Corporation, 39 Broadway, New York City, has leased 25 acres of land at the new municipal airport, Baltimore, and will construct a plant which, with equipment, will cost more than $1,000,000. The plant will manufacture aircraft, principally large seaplanes, and is expected to begin production about January 1. Frank H. Russell is president of the company and Capt. G. C. Westervelt is general manager.

The Miami Aircraft Corp., organized at Miami, Fla., recently with $500,000 capital, will erect a $250,000 factory this year for the manufacture of a new type of amphibian monoplane, it has been announced by Joseph C. Smoot, president of the new company. The company expects to have the initial unit of the plant ready to start production during the coming summer.

The Hill & Somers Aerial Service, Inc., Bethany, Conn., has been incorporated with a capital of $50,000 to manufacture airplanes. The incorporators are: J. Gray Somers, Merran C. Hill and Katharine R. Starburck, all of Waterbury.

The Multiplane Aircraft Corporation, Waterbury, Conn., has incorporated with a capital of $50,000 to manufacture aircraft and deal in aeronautical equipment. The incorporators are: Nathanial R. Bronson, Lawrence L. Lewis and Richard Bronson all of Waterbury.

BUSINESS BAROMETER . . . . . *There is a lessening of activity and a restriction of enterprise, but most authorities think the summer reduction will be less than usual*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

THE decline in stock prices recorded last week was not unexpected by those who have been able to detach themselves from the unreasoning enthusiasm for higher prices that has obsessed the American public for the last year or more, but even those who foresaw the downfall of the bull market were amazed by its precipitancy. Curiously enough it came just as call money had commenced to grow easier, and the Federal Reserve Board by failure to approve the advance in the rediscount rate requested by the larger Reserve Banks, left it to be inferred that it was opposed to any increase at present.

The truth seems to be that the continued talk of higher interest rates and the wide publicity that has been given to the cost of credit, have got upon the nerves of a great many who were carrying stocks on margin. The result has been a change of sentiment, and a disposition to liquidate at least a part of the securities held at the market, even though prices were substantially lower than could have been obtained a month or more ago.

But it is probable that the decline in wheat had more to do with the selling in the stock market than the fear of tight money, which is now passing as the liquidation in the stock market progresses. Last week, for the first time since 1914 wheat sold at under a dollar a bushel in Chicago. The lowest price touched up to this writing was 93¼ for May delivery, and the psychological as well as the financial effect of the decline has been profound. Coming as it did while Congress was fighting over the farm relief bill, it caused more or less consternation. It presages a smaller farm purchasing power and a decline in the sales of some industries, such as farm implements and automobiles, which are important buyers of raw materials, and it has led many to ask whether other commodities, many of which are already sagging, will follow suit.

One of the statistical organizations which pays particular attention to the merchandise markets asserts that the average of commodity prices is now at the lowest level reached since the decline from the peak point of 1920. The statement loses some of its significance when the basis used in computing the average is examined, but it is a striking fact that most of the commodity markets are lacking in bull initiative at present, and that the appeal of those who represent the farmers in demanding governmental relief is finding a wider audience day by day.

For this reason it is to be feared that the unsteadiness of commodity values will continue, at least until Congress has agreed upon a measure of farm relief that will be acceptable to President Hoover, and it cannot be said that the week's developments have hastened the approach of a consummation so devoutly to be wished.

GENERALLY throughout the country the machine tool industry is entering the summer months with no anticipation of any material let-up in activity in sight. It is not anticipated that, as happened last year, there will be any record-breaking sales in July or August after the tremendous activity of early spring, but no seasonal slump is looked for, such as was the regular experience for several years prior to 1928. The volume of May sales compared favorably with that of April, and in some cases exceeded it, although April generally was a record-breaking month. The only section locally depressed is Cleveland.

DELIVERIES are getting no better and in some cases are becoming longer. The employment situation also remains acute in that there is still a decided shortage of skilled men. Employment in Milwaukee, whose industries are largely metal-working, is above the post-war peak of 1920, and in Detroit is far above the level of last year.

AUTOMOTIVE buying for the present has slackened off, but general industry is still purchasing on a large scale in the aggregate, although in small units. The only large quantity buying at the present time seems to be by the Western Electric Co. for its huge plant being erected in Baltimore where more workers will be employed than are now at Hawthorne, Ill. Railroad buying still remains disappointing and below the level of last year. In Chicago the roads are gradually completing purchases against lists issued earlier in the year, and no new lists are in sight.

Meanwhile, some additional evidence of a lessening of activity and a restriction of enterprise are to be noted. The automobile industry in May reduced its output somewhat as compared with April, and as the leading trade reviews say that new car stocks represent from 40 to 45 days' supply it is likely that June will bring a greater recession. This for some time has appeared inevitable and it will shock no one. Nevertheless it will be felt by the steel and the other industries which supply materials, and it is not surprising that a slight falling off in demand and a probable curtailment in production are indicated in some of the steel reviews. But most of the authorities insist that the summer reduction will be less than usual.

Building continues the laggard among the major industries although it has been speeded up somewhat since the early part of the year.

Cotton textiles are quieter as the expectation of a substantial increase in the cotton acreage becomes more definite, and the reports of an impending curtailment by the mills have been without effect on the goods markets. Silk fabrics and woolen goods are also hesitant as a result of the uncertainties in which the proposed tariff revision has become involved. For the same reason sugar is at nearly the lowest price on record.

The demand for copper, though still large, is not as active as it was and sales are said to have been made slightly under 18 cents a pound. The trade in hides and leather reflects a slight contraction in distributive demand.

Taken all in all it cannot be said that optimism has increased during the week, and most merchants seem disposed to follow a cautious policy until the commodity markets have become steadier, the stock market has recovered its stability, and the fear of higher interest rates has passed.

The victory of the Labor Party in the British elections held on Thursday will be called "unsettling" by the conservatives, but a Labor government is no longer new in Great Britain and business will probably be carried on as usual. The other foreign news of importance is that a solution of the reparations problem has almost been reached with an agreement upon the annuities to be paid by Germany. The importance of this settlement is not in its terms but in the removal of a perplexing and discouraging controversy from international business, and European production and consumption eventually must be stimulated by it.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CLEVELAND

Local sales of machine tools continued to slump during the past two weeks. The slowing up of production in local automotive accessory lines and the inactivity of the general industrial plants in Cleveland is responsible for the declining local sales activity. Nationally, business is better with a more diversified line participating in the buying, but sales have been limited to one and two tools to replace obsolete machines. Inquiries are holding up fairly well, but are mostly confined to information on single tools of more efficient types. Present conditions are satisfactory however, as producers are far behind in their production schedules. The machine tool line is the busiest industry in Cleveland today. Production is on a par with war time conditions. Considerable trouble is being experienced in obtaining suitable mechanics, and wages of skilled machinists are at a peak. The press of machine tool production has reached such a height that several concerns that were manufacturing household appliances as a side line have discontinued this practice and are devoting full time to tool production.

NEW ENGLAND

The past week has developed no definite change in the New England metal-working industry, and manufacturers of machine tools anticipate activity at the present level practically throughout the summer months. The industry continues to be well occupied at a level substantially above the corresponding period a year ago. The present rate of new business, which has resulted from slight declines from time to time through the month of May and part of April, is heavy enough to assure sufficient activity to preclude little hope of better deliveries for several months to come.

The used tool market is more or less spotty due in a greater measure to a general absence of modern used machines, than to a slackened demand. New sources of supply bring usually a good number of desirable machines, but any number of A1 units, seem to be readily exhausted. Dealers as a whole are not always well stocked.

Buying of road machinery holds up well, and there is a strong demand for all kinds of mechanical handling and conveying equipment. Machine shop tools are selling good, and there is apparently no end to this demand. Power plant generating equipment is a prominent factor in New England business with potential new market being anticipated at Framingham, Mass. The New England Power Co. is buying heavily at the present time. Textile machinery builders continue to show improved business.

CHICAGO

Business in machine tools for the month of May, according to manufacturers' representatives, distributors and dealers, closed with a record of sales that places it on a level with any of the preceding months this year. In a few cases it was reported as exceeding in volume that of any other month. It was further said that no signs of a let-up in the near future are indicated, and the prevailing expectation is that the present high level will be maintained throughout June. This is predicated on the volume and nature of inquiries coming in, the sources being widely separated as to territory, and the inquiries referring to practically all types of shop equipment.

Railroads gradually are reducing the number of outstanding items on their lists, but it will be several weeks yet before buying against them is finished. The International Harvester Co. is reported to have issued a new list of requirements comprising a number of standard tools. John Deere & Co. are in the market for equipment needed in their Waterloo (Iowa) plant. Automotive and automobile accessory manufacturers continue to buy freely. The bulk of the business being transacted, however, is with industrialists and machine shops, the Chicago territory contributing largely to this demand.

BUFFALO

The machine tool trade in Buffalo held up well in May. One dealer went so far as to assert that his May business this year was double that of one year ago, and all were united in the opinion that the business was very much better than that of a year ago.

In most instances it was stated that inquiries had dropped off a bit during the last week of the month, but in one instance it was reported that inquiries had increased during the last ten days of the month. Everything seems to point to a summer more than usually good despite the vacation season and the prevailing habit of letting things slide a bit during the warm months.

In the electrical equipment field reports were equally reassuring. One company reported a large order of transformers placed with a utility company in this district during the month and a large volume of small orders, which has been common for several months, were also placed.

The new plant of the Curtiss Aeroplane & Motor Co. is virtually completed but one of the new hangars at the Buffalo Airport has been assigned to Curtiss to enable this company to speed up its assembly of fly-away planes. It is reported also that the Consolidated Aircraft Corporation has applied for construction permits to increase its hangar facilities at its own air field in the township of Tonawanda.

The summer weather which broke during the last week in May swiftly accelerated construction both of buildings and highways with the result that there was more activity in this equipment field than has been the case in several months.

PHILADELPHIA

Basic conditions in the machinery and machine tool trade in the Philadelphia market continued to be sound during the last two weeks. The period was not marked with any large orders, but shops were busy with those previously placed. Leaders of the industry do not look for an immediate slump.

Orders for some small tools have come from general industrial establishments, but some tool builders reported a falling off in activity. The fact that inquiries have been holding up well during the early summer months indicates to the leaders of the industry that the usual midsummer falling off in activities will at least be delayed this year.

Sales during the month of May exceeded those of the corresponding period of a year ago. There has been little response from railroads to the industry's hope for some active buying from carriers. Public work in Philadelphia is holding up. Additional subway construction, for the city's account will exceed $20,000,000 over a period of two years. This includes lines into the Northeast section of the city for the development of new industrial sites.

CINCINNATI

The great majority of the machine tool manufacturers in the Cincinnati district report that in the past week a steady inflow of orders sustained business at an excellent level. With a small number there was a slight lull, but this was offset by gains made by others, and taking the trade as a whole the daily sales average remained practically the same as in the previous week. The statement of one manufacturer seems to reflect the general view, it being that "business is very stable, with very little change from week to week, and inquiries indicate that this condition will continue."

Selling agents report that during the past week business continued to be good in local and adjacent territory, with the replacement of obsolete tools as the principal feature. A good volume of new business is developing, it is stated, and all indications are that there will be a continuance of the present good demand through the present month at least.

With the manufacturers the week's business feature was the sale of single tools to miscellaneous users. Orders booked came from all sections of the country and were well diversified. Purchases made by railroads and concerns in the automotive industry were neither numerous nor large.

The great majority of the manufacturers report that a good volume of inquiries of excellent tone were received in the week, by far the larger portion of which were from miscellaneous users, whose requirements were single tools and replacements. No inquiries of importance are reported as having come from either railroads or concerns in the automobile field.

MILWAUKEE

Immediate indications are to the effect that the usual summer slackening in metal-working equipment demand will either be absent or it will be much less pronounced than perhaps in any year since the War. So far as production is concerned, this undoubtedly will continue at the noteworthy high rate of recent months, at a much higher level than in recent years, due to the large volume of unfilled orders that are being carried into the summer months by most manufacturers of machine tools.

The automobile industry seems to be more inclined to mark time in the acquisition of new equipment than for several months past, probably having placed its needs for the present and awaiting completion of deliveries before proceeding further. Such shops are furnishing a substantial quantity of business in small-sized orders, but with the exception of a few isolated instances no large lots are coming from that quarter. The situation in this respect is by no means unexpected in view of the relatively enormous absorption of equipment during the past six to eight months. Meanwhile other groups of industries almost without exception are placing orders in greater or lesser quantities. In the main, however, it would appear that urgent replacements are predominant in fresh business.

Using the previous peace-time peak

reached in March, 1920, as 100 per cent, official figures compiled by the Milwaukee Metal Trades & Founders Bureau indicate that the number of men at work and the volume of production in Milwaukee machine shops and foundries at this time is 102 per cent, which represents a steady, consistent gain from the 50 per cent to which the index dropped during the slump in 1921. The significant statement is made in announcing the results of the compilation that "there is not a sign disturbing the prospects of the future."

DETROIT

In the face of consistent rumors and predictions indicating a slowing up of the automotive industry the volume of sales of machinery and machine tools in this area is maintaining a steady level and within the past week has given promise of substantial development during the remainder of the year. A majority of the outstanding dealers report the receipt of large numbers of inquiries from automobile and parts manufacturers.

A great many new models are being planned and numerous expansions are contemplated by automobile companies. There is a tendency toward eight-cylinder cars and many of the inquiries that have been received within the past few weeks indicate that several manufacturers expect to add this type of motor to their lines. During the month of May a great many propositions were made by prospective buyers, but few large orders were placed. The orders that are being received are mostly for production and replacement equipment and for tool and die room fixtures.

Some dealers are still several months behind on deliveries but for the most part orders are not as far ahead of deliveries as they were a few weeks ago.

A general lull was experienced in the machinery and machine tool trade in May and the latter part of April. It is interesting to note that in spite of this fact the dealers in industrial motors and power machinery reported unusually heavy sales. One representative dealer sold four times as many motors to the automotive industry in May as in the same month of 1928. Sales of this type of equipment are still increasing and this fact, taken with the many other indications, point to a general plan of expansion throughout the industry during the last half of the year.

General business conditions in Detroit and throughout industrial Michigan are a little better than fair. Many lines of activity are marking time and others are going at a normal rate. In general it might be said that conditions in all lines are about normal with employment at a slightly lower level than it was six weeks ago.

NEW YORK

For the past year the metropolitan area has been one of the leading markets for machine tools. While a large volume of sales in small units to general industrialists has continued to feature this activity in sales, it seems that there is always at least one large buyer occupying the center of the stage. For the time being it is the Western Electric Co. that falls into this classification. Most of the purchases being made by this company are for the large unit being constructed at Baltimore, but local dealers also anticipate large purchases of additional equipment in coming months for the Kearny plant.

On the whole the volume of sales made in May equalled the April volume, which was high, so that conditions may be said to be fairly well stabilized at a high level. Dealers and factory representatives enter the summer months with considerable optimism, and none can see any material signs of a let-up in the near future. No record-breaking sales are expected to be made this summer as was the case during last July and August, in view of the tremendous activity of early spring, but a steady volume of sales is anticipated for some time to come.

Deliveries in a few cases have improved, but in the majority of cases are becoming longer. The price trend continues upward. On the first of June a shaper manufacturer announced an average price rise of about 7½ per cent. Prices on used equipment are holding up well due to the demand for second-hand machinery in good condition.

Importers of machine tools are marking time until Congress has finally settled on tariff changes.

Sales made by the Triplex Machine Tool Co. in the past week are indicative of the general activity: One Swiss jig borer, an Ames bench miller, two Campbell nibblers, a floor milling machine, a Rivett precision lathe, two small engine lathes, and a bench drill press.

Business Items

Darwins Limited, Sheffield, England, a merger of several Sheffield steel concerns, and one of the pioneers of high-percentage chromium steels, and makers of a patented cobalt-chromium steel and of the "Darwin" safety razor blades from the same material, was reorganized recently with a capital of £730,000 of which £530,000 were issued and fully subscribed. The directors of the new company propose to enter on a very much larger manufacturing and selling program, extending outside of alloy tool steels and safety razor blades to kindred products. The American Division of Darwins Limited is represented by Darwin & Milner, Inc., 1260 West 4th St., Cleveland, Ohio, of which Victor F. J. Tlach is president.

A merger of the Manhattan Rubber Manufacturing Co., of Passaic, N. J., The Raybestos Co. of Bridgeport, Conn., and the U. S. Asbestos Co. of Manheim, Pa., has been consummated through the banking firms of Hayden, Stone & Co., and the Equitable Trust Co. of New York. A company will be formed to take over the stock of these three concerns, but each of the individual companies will be conducted by their present officers, and there will be no changes in the personnel or management of these individual units. As far as the manufacture of brake linings and clutch facings goes, the new company will be the largest individual unit in the business.

The Kearney & Trecker Corporation, Milwaukee, manufacturer of milling machines, has acquired the plant of the defunct Gerlinger Electric Steel Casting Co. at Sixtieth and National Avenues, in close proximity to its shops. Definite disposition of the Gerlinger property remains to be determined. The main foundry, it is stated, will be remodeled and used as an expansion unit for either the Kearney & Trecker Corporation or the LeRoi Co., manufacturer of gasoline engine, owned by the same interests.

The General Engineering Works, manufacturers of screw machine products, recently incorporated and continuing the business of the partnership operating under the same name, is now installed in its new plant at 4701 West Division St., Chicago. The new plant is a one-story structure having triple the floor space of the old plant. It is well lighted and has been laid out for straight line production.

The B. C. Ames Co., of Waltham, Mass., has opened a factory branch office at 902 Stephenson Building, Boulevard & Cass Ave., Detroit, under the management of E. D. Haggerty. All models of Ames dial gages and replacement parts will be stocked and a repair department maintained.

The Wagner Electric Corporation of St. Louis, Mo., has moved its Buffalo service station and branch sales office to a new building at 1796 Main St. The new building was built in accordance with Wagner specifications in order to facilitate the handling of standard Wagner lines and in service work.

The Rockford Drilling Machine Co., Rockford, Ill., has merged with the Borg-Warner Corporation. There will be no change in management or policies of the Rockford concern and the same lines will be continued as heretofore.

The Alemite Manufacturing Corporation of Chicago has changed its name to the Alemite Corporation to avoid confusion with the Alemite Die Casting & Manufacturing Company.

The Vanadium Corporation of America has moved its Chicago office from Suite 1604 Straus Building to Suite 2104 in the same building.

Personals

J. R. WINTERS has resigned as general superintendent of the Youngstown Pressed Steel Co., Warren, Ohio, and has become vice-president in charge of operations and a part owner of the Peter Smith Stamping Co., formed in Detroit 18 months ago. Mr. Winters started in the pressed steel industry some years ago with the U. S. Motors in Detroit. Later he spent some years in charge of pressed steel operations of

the Military Ave. plant of the Kelsey-Haynes Wheel Co., Detroit, then went with the Gier Pressed Steel Co. of Lansing, Mich., a concern that was later merged with the Motor Wheel Corporation. While here he developed the first steel wheel with demountable rims used on automobiles. From there he went to the Youngstown firm in 1922.

J. S. TRITLE, who on May 1 was placed in charge of manufacturing operations of the Westinghouse Electric & Manufacturing Co., with headquarters at Pittsburgh, Pa., was made a vice-president of the company on May 27. A native of Nevada and a Yale graduate, Mr. Tritle has been an outstanding figure in the electrical industry since 1893. After managing the Kansas City and St. Louis district sales offices for a number of years, in 1922 he was made manager of the merchandising department, supervising the sales of that department's products. In 1925 he assumed full charge of the engineering and manufacturing as well as sales work of the merchandising division, with headquarters at Mansfield, Ohio.

ARTHUR W. GRAY, has joined the staff of The Brown Instrument Co., Philadelphia, as associate director of research. He will be engaged mainly in the development of scientific and industrial instruments. Dr. Gray established the Thermal Expansion Laboratory of the Bureau of Standards and originated important methods and apparatus that are still in use there. During the last thirteen years, he had served as director of physical research of the L. D. Caulk Co., and vice-president and director of research of Dielectric Products, Inc.

MILTON L. GEARING, formerly in charge of the Philadelphia sales district for the New Departure Manufacturing Co., has been appointed manager of the Elmwood Division of the company in place of Sidney E. Stockwell, resigned. Mr. Gearing has been with the company since he graduated as a mechanical engineer at Rensselaer Polytechnic Institute in 1923.

G. O. FORSETH, formerly sales representative of the Lincoln Electric Co. at Detroit, Mich., has been promoted to district sales representative with headquarters at Minneapolis, Minn. B. W. BROWN has been advanced to district sales representative of the same company with headquarters at Milwaukee, Wis.

ARNOLD L. NACKE, who was formerly connected with Manning, Maxwell & Moore, Inc., as sales engineer and lately with Knickerbocker, Cram & Co., Inc., both of New York, is now sales engineer in the machine tool department of Joseph T. Ryerson & Son, Inc., at their Jersey City (N. J.) office.

RICHARD A. HEALD who has been closely connected with the sales division of the Heald Machine Co., Worcester, Mass., is now chief engineer of the company. WALDO GUILD who formerly held the position of chief engineer, is now consulting engineer for the company.

GEORGE A. SMITH, assistant production supervisor of the Meriden (Conn.) plant of the New Departure Manufacturing Co., has been appointed production manager of the Elmwood plant of the company. He was at one time assistant production manager of the Aeolian Co., also of Meriden.

D. B. CARSWELL, head of the marine department of Canadian Vickers, Ltd., has been appointed general manager of the company. Mr. Carswell has been acting in that capacity for some time, pending the sanctioning by shareholders of an amendment to the by-laws creating the position.

J. E. MILLS, of Smith & Mills Co., Cincinnati shaper manufacturer, has just returned from a trip to South America.

Obituaries

MURRAY SHIPLEY, who with William Lodge formed the Lodge & Shipley Machine Tool Co., Cincinnati, in 1892, died at his home in Cincinnati on May 30, after a brief illness. Mr. Shipley was born in Cincinnati in 1865 and attended the Chickering Institute of Cincinnati and then went to the

Sheffield Scientific School, Yale University, from which he was graduated in 1885. He was in the mercantile business for one year and subsequently for two years was with the Manley & Copper Co., of Philadelphia, doing structural iron work. For four years he was with Sechler & Co., manufacturers of vehicles in Cincinnati and then helped to form the Lodge & Shipley Machine Tool Co. He has been president of the National Metal Trades Association and president of the Cincinnati branch of that association.

WILLIS H. DIEFENDORF, president and treasurer of the Diefendorf Gear Corporation, Inc., Syracuse, N. Y., died on May 25 at the age of 59. Associated for nearly 30 years with the late Thomas W. Meachem in the old New Process Rawhide Co., Mr. Diefendorf aided in the change from that name and business to the New Process Gear Corporation, which was operated by John N. Willys and later by the Durant interests. Retiring from the New Process Gear Corporation in 1920, Mr. Diefendorf founded the Diefendorf Gear Corporation.

HAROLD TREADWELL WHITNEY, head of the Whitney Machine Co., Winchester, Mass., died May 23 at his home in Winchester. Mr. Whitney was a native of that city and had been connected with the Whitney company for many years. He is survived by two brothers.

GEORGE GUMMERY, London district manager of the Associated British Machine Tool Makers, Ltd., since the formation of the company in 1917, died on April 17 at the age of 53. Previously he was on the staff of James Archdale & Co., Birmingham.

GEORGE T. GWILLIAM, president of the Gwilliam Co., manufacturer of ball bearings with plants in Philadelphia and Brooklyn, died on May 25 of heart disease at the age of 69.

FRANK MOORE BOSTWICK, 71, for many years assistant general superintendent of the Pullman Co., died on May 22 at his home in Philadelphia.

JAMES LEWIS, senior member of the ironworking firm of William Lewis and Sons, of St. John, New Brunswick, died at his home in that city on May 23.

Forthcoming Meetings

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

NATIONAL METAL CONGRESS. To be held in Cleveland September 9 to 13. Simultaneous meetings of the American Welding Society, the Institute of Metals Division of the American Mining & Metallurgical Engineers, the Iron & Steel Division, American Society of Mechanical Engineers, the Iron & Steel Division, A.I.M.E., and the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL METAL EXPOSITION. Eleventh annual, held under the auspices of the American Society for Steel Treating, Cleveland Public Auditorium, Cleveland, Sept. 9-14. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 826 Provident Bank Bldg., Cincinnati.

The Weekly Price Guide

Rise and Fall of the Market

WITH steel production at mill capacity, there is every indication of a continuation of current prices well into the third quarter. Non-ferrous metals are also holding up as to price, with two slight exceptions in the form of declines in slab zinc and antimony, respectively. Zinc is down 0.05c. per lb. (6.60c.) at East St. Louis; antimony dropped 0.5c. per lb. (13c.) at Cleveland, during the week. Scrap prices remain steady owing to firmness in the raw metals.

(*All prices as of May* 31, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	21.25
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	24.79
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20 26
Basic	20 26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.25	3.90*
No. 12	2.15@2.25	3.40	3.30	3.95*
No. 14	2.25@2.35	3.45	3.35	4.00*
No. 16	2.35@2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.65@2.75	3.85	3.70	3.80
No. 22	2.80@2.90	4.00	3.85	3.95
No. 24	2.85@2.95	4.05	3.90	4.00
No. 26	2.95@3.05	4.15	4.00	4.10
No. 28	3.10@3.20	4.75	4.15	4.25
Galvanized				
No. 10	2.80@2.90	4.20	4.05	4.05
Nos. 12 to 14	2.90@3.00	4.30	4.15	4.15
No. 16	3.00@3.10	4.40	4.25	4.25
No. 18	3.15@3.25	4.55	4.40	4.40
No. 20	3.30@3.40	4.70	4.60	4.55
No. 22	3.35@3.45	4.75	4.65	4.60
No. 24	3.60@3.70	4.90	4.75	4.75
No. 26	3 75@3.85	5.15	5.00	5.00
No. 28	4.00@4.10	5.40	5.25	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Glav.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
¼	$0.17	1.315	1.049	.133
½	.23	1.66	1.38	.14
¾	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

— Thickness — Decimal Fractions	B.w.g. and	Outside Diameter in Inches ¼	⅜	½	⅝	¾	1	1¼	1½
		Price per Foot							
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23	
.049"	18	.17	.18	.19	.20	.21	.23	.25	
.065"	16	.19	.20	.21	.22	.23	.25	.27	
.083"	14	.20	.22	.23	.24	.25	.27	.29	
.095"	13	.21	.23	.25	.26	.27	.29	.31	
.109"	12	.22	.24	.26	.27	.28	.30	.32	
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33	
.134"	10	.24	.26	.28	.29	.30	.32	.34	

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{5}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.00
Lead, pigs, E. St. Louis	6.80	New York	8.25
Zinc, slabs, E. St. Louis	6.60	New York	8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.50	13.00	14.25
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	19.87½	19.87½	19.87½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	32.50	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			61.00
Commercial genuine, intermediate grade.....			45.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	13.50 @13.75	13.50	13.00 @14.00
Copper, heavy, and wire..	13.50 @13.75	13.00	12.00 @13.00
Copper, light, and bottoms	12.00 @12.25	12.50	11.00 @12.00
Heavy lead.....	5.12½@ 5.62½	6.25	5.00 @ 5.50
Tea lead.....	2.37½@ 2.87½	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	9.00 @ 9.25	8.00	8.00 @ 8.50
Brass, heavy, red.....	.....	12.50	12.00 @12.50
Brass, light.....	7.37½@ 7.50	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.25 @ 9.50	9.00	10.00 @10.50
Zinc.....	3.75 @ 4.00	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.02¾	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.111	.11	.114
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2125	.2487½	.1675
Solder (½ and ½).....	per lb..	.325	.35	.3375
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...		Connellsville,	2.75@2.85
Coke, prompt foundry, per net ton...		Connellsville,	3.75@4.50
White lead, dry or in oil...	100 lb. kegs....	New York,	13.75
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7/16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

Ind., Elwood—Indiana Box Co.—machinery and equipment for the manufacture of boxes for radio and other plants to double capacity. Estimated cost $20,000.

Ind., Muncie—Warner Gear Co.—machinery and equipment for the manufacture of gears for automobiles. Estimated cost $80,000.

Mass., Roxbury (Boston P.O.)—Schoolhouse Dept., City Hall, Boston — woodworking machinery for Horace Mann school, Kearsarze Ave. here.

Mass., Fairhaven—Fairhaven Iron Foundry, Water St.—additional machinery and equipment for proposed 1 and 2 story iron foundry destroyed by fire.

Mass., Walpole—Hollingsworth & Vose, 333 Washington St., Boston—machinery and equipment for machine shop here.

Mich., Detroit—Leland Detroit Mfg. Co., 5680 12th St.—milling machine.

Mich., Detroit—Reliable Tool & Die Co., 734 Mt. Elliott Ave.—radial drill and equipment.

R. I., Providence—Bd. of Contract & Supply, City Hall—machinery and equipment for manuel training departments of E. Hopkins and G. J. West high schools.

Tex., San Antonio—Yellow Cab Co. Inc., c/o W. G. Duncan, Pres., Main Ave.—machinery and equipment for proposed 1 story, 140 x 250 ft. garage at Crockett and Nacogdoches Sts. Estimated cost $110,000.

Ont., Chatham—Hayes Wheel & Forgings Ltd.—machinery and equipment for the manufacture of automobile wheels, universal joints, shafts, clutches and rear axles for proposed 1 story, 200 x 400 ft. addition to factory. Estimated cost $250,000.

Ont., Newmarket—Office Specialty Mfg. Co., H. C. Slemin, Mgr.—woodworking equipment for proposed 3 story, 55 x 200 ft. addition to factory on Timothy St. Estimated cost $100,000.

Ont., Stratford—Kroehler Mfg. Co., F. W. Trebell, Mgr.—woodworking equipment for proposed 3 story, 65 x 100 and 45 x 100 ft. additions to factory on Ontario St. Estimated cost $100,000.

Ont., Walkerville — E. H. Sheldon & Co., Muskegon, Mich.—machinery and equipment for the manufacture of school and laboratory equipment here.

Ont., Windsor—Champion Spark Plug Co., A. Hayes Mfg.—machinery and equipment for the manufacture of spark plugs for proposed addition to factory. Estimated cost $150,000. Private plans.

Opportunities for Future Business

Calif., Los Angeles — El Travia Industrial Terminal Corp., 6600 Lexington Ave., awarded contract for the construction of a 12 story aviation plant on 33rd St. Estimated cost $5,000,000.

Calif., San Francisco—Pacific Gas & Electric Co., 445 Sutter St., is receiving bids for a 1 story garage and service building at 18th and Shotwell Sts. Estimated cost $100,000.

Conn., Hartford — Hartford Builders Finish Co., 34 Potter St., awarded contract for a 2 story woodworking plant on Mechanic St. Estimated cost $75,000.

Conn., Hartford—Wiremold Co., 410 Asylum St., is receiving bids for a 2 story, 98 x 200 ft. factory. Estimated cost $175,000. Greenwood & Noerr, 525 Main St., Archts.

Conn., New London — New London Aviation Co., S. M. Gruskin, 615 Bank St., plans the construction of an airport including hangars, etc. Estimated cost $25,000. Architect not selected.

Conn., Norton—State Bd. of Finance, State House, Hartford, is having plans prepared for a 2 story, 40 x 140 ft. service building including carpenter and electric shops, etc. for Fitch Home for Soldiers here. Estimated cost $90,000. Payne & Keefe, 231 State St., New London, Archts. Noted May 30.

Conn., Stamford — Stamford Water Co., Summer St., will receive bids until June 12, for a 2 story, 55 x 90 ft. shop. Estimated cost $40,000. Butler & Provost, 35 Atlantic St., Archts.

Conn., Waterbury—Lux Clock Mfg. Co., 97 Sperry St., is receiving bids for a 4 story, 45 x 150 ft. factory on Johnson St. Estimated cost $150,000. T. M. Freney, 51 Leavenworth St., Archt. Noted May 9.

Ill., Bensenville — Wills Motor Corp., First Ave. and Main St., Maywood, will soon receive bids for a 1 story, 60 x 1,600 and 90 x 90 ft. factory here. Estimated cost $1,200,000. Noted May 24.

Ill., Chicago — Coil Spring Co., Carroll and Albany Aves., awarded contract for a 1 story, 77 x 116 ft. factory. Estimated cost $20,000.

Ill., Chicago — Western Electric Co., Hawthoren Station, awarded contract for a 1 story, 75 x 100 ft. addition to plant at 2200-2410 Kenneth Ave. S. Estimated cost $30,000.

Ill., Rockford—Sall Bros Inc., manufacturers of castings, automobile heaters, awarded contract for a 1 and 2 story, 66 x 145 ft. plant on Kishwakee St. Estimated cost $100,000.

Ind., Fort Wayne—Dudlo Mfg. Co., Wall St., awarded contract for a 1 story, 167 x 210 ft. factory at Swinney & Phenie Sts. Estimated cost $70,000.

Ind., Indianapolis—G. J. Mayer, East Market St., manufacturer of stamps, awarded contract for the construction of a factory. Estimated cost $40,000. Vonnegut-Bohn & Mueller, Indiana Trust Bldg., Archts.

Mass., Attleboro—Mossberg Pressed Steel Co., 81 West St., awarded contract for a 1 story, 60 x 140 ft. addition to factory. Estimated cost $40,000. Noted May 24.

Mass., Lexington (Boston P. O.)—L. W. Bills, 73 Hancock St., awarded contract for a 2 story machine shop.

Mich., Flint—Chevrolet Motor Co., is having plans prepared for a 1 story, 240 x 375 ft. factory and service building. Estimated cost $500,000. Wright & Nice, 220 Dort Bldg., Archts.

Mich., Marysville—Pressed Metals of America, Inc., awarded contract for a 2 story, 50 x 70 ft. metal working plant at Gratiot Rd. Estimated cost $50,000.

Mich., Mount Clemens — Constructing Quartermaster, will receive bids until June 14, for the construction of a group of buildings including machine shop, assembly hangar, etc. at Selfridge Field.

Minn., Minneapolis—L. B. Barnes, 4505 Moorland Ave., Edina, awarded contract for a 2 story garage at Broadway and Girard Ave. N. here. Estimated cost $100,000.

Mo., St. Louis—Alexander Airchaft Co., J. D. Alexander, Pres., Colorado Springs, Colo., is having preliminary plans prepared for the construction of an aircraft assembly plant here. Estimated cost $45,000.

Mo., St. Louis—Multiplex Display Fixture Co., 918 North 10th St., awarded contract for a 2 story, 57 x 105 ft. factory. C. G. Schoelch & Co., 1247 Syndicate Trust Bldg., Archts.

N. J., East Rutherford (br. Rutherford)—L. B. Huesmann, Archt., is receiving bids for a 2 story, 50 x 130 ft. factory at Boiling Springs Ave. and Orchard St. for Keystone Falicon Press Inc., 15 Ames Ave., Rutherford. Estimated cost $70,000.

N. J., Elizabeth—National Electric Products Corp., Bayway, awarded contract for a 1 story, 95 x 360 ft. rolling mill at South Front St. and Bayway. Estimated cost $100,000.

N. J., Lodi—Metakloth Co. Inc., Garibaldi Ave., is having plans prepared for a 1 story addition to factory. Estimated cost $40,000. Liebau & Breiby, 238 Main St., Hackensack, Archts.

N. J., Newark—J. C. Kohaut, Inc., 117 Green St., is having sketches made for a 2 story woodworking plant 173-177 New Jersey Railroad Ave. Estimated cost $40,000. Architect not announced. Noted May 24.

N. Y., Brooklyn—Brooklyn Borough Gas Co., M. E. Dillon, Pres., Mermaid Ave. and W. 17th St., plans the construction of a 157 x 197 ft. garage and shop at Neptune Ave. and Shell Rd. Estimated cost $300,000. Block & Hesse, 18 East 41st St., New York, Archts.

N. Y., Brooklyn — Commercial Exchange Corp., L. Wolfson, Pres., 16 Court St., plans the construction of a garage at Gravesend Neck Rd. and 26th to 27th Sts. Estimated cost $40,000. Seelig & Finkelstein, 66 Court St., Archts. Maturity Sept.

N. Y., Brooklyn—J. L. Construction Co., 133 Floyd St., plans a 1 story, 100 x 200 ft. garage at Union and East 98th Sts. Estimated cost $45,000. H. M. Sushan, 367 Fulton St., Archt.

N. Y., Brooklyn—F. Serdenberg, 504 Montgomery St., plans the construction of a 1 story, 100 x 120 ft. garage at Lorimer St. and Marcy Ave. Estimated cost $60,000. H. J. Nurick, 44 Court St., Archt.

N. Y., Long Island City—Anchor Cap & Closure Corp., Queens St. and Jackson Ave., awarded contract for a 6 story, 80 x 308 ft. factory at Dutch Kills St. here. Estimated cost $500,000. Noted Apr. 18.

N. Y., Long Island—Constructing Quartermaster, will receive bids until June 14, for the construction of a group of buildings including machine shop, etc. for Air Corps Barracks, Mitchel Field here.

N. Y., Long Island City—National Casket Co., 470 Jackson Ave., awarded contract for a 5 story, 82 x 112 ft. factory.

O., Cleveland—Great Lakes Aircraft Corp., C. F. Van Sicklen, Sales Mgr., 16800 St. Clair Ave., awarded contract for addition to factory. Estimated cost $75,000.

O., Cleveland — Midland Steel Products Co., West 106th St. and Madison Ave., awarded contract for a 1 story, 45 x 62 ft. machine shop at 2080 West 106th St. Estimated cost $40,000.

O., Cleveland—Superior Screw & Bolt Co., 3650 East 93rd St., awarded contract for a 1 story, 80 x 107 ft. addition to factory. Estimated cost $40,000.

O., Youngstown—Youngstown Steel Door Co., awarded contract for a 1 story factory including shops, etc. Estimated cost $250,000.

Okla., Muskogee—City, awarded contract for an airport including hangar, repair shops, etc. Estimated cost $100,000.

Pa., Pittsburgh—Pittsburgh Equitable Meter Co., 400 Lexington Ave., awarded contract for a 1 story addition to factory. Estimated cost $50,000.

Pa., Pittsburgh—Ruud Mfg. Co., 29th and Smallman Sts., awarded contract for a 2 story addition to factory. Estimated cost $50,000.

Pa., Pittsburgh—K. Simon, 160 Fullerton St., is having plans prepared for a 2 story, 45 x 65 ft. wagon shop. Estimated cost $40,000. A. R. Douglass, Jackson Bldg., Archt.

Tenn., Memphis—U. S. Engineer Office, will receive bids until June 17, for the construction of a shop and warehouse at U. S. Supply & Repair Depot. Noted May 9.

Tex., Mercedes—American Box & Crate Co., 1315 East 7th St., Los Angeles, Calif., is receiving bids for a 1 story, 75 x 100 ft. factory here. Estimated cost $35,000. Private plans.

Tex., San Antonio—R. Thompson, Texas Theatre Bldg., awarded contract for a 1 story, 111 x 168 ft. garage and service building at Main and Poplar Sts. Estimated cost $125,000. Packard Motor Co., Augusta St., lessee.

Wash., Seattle — Fisher Body Co., General Motors Bldg., Detroit, Mich., awarded contract for first unit of plant on East Marginal Way here. Estimated cost $500,000.

B. C., Vancouver — Boeing Aircraft Co. of Canada, Georgia St. W., awarded contract for a 1 story airplane factory. Estimated cost $100,000. Noted May 9.

Ont., Copper Cliff—International Nickel Co., 67 Wall St., New York, N. Y., awarded contract for a customs copper refinery. Estimated cost $4,000,000. Noted Apr. 11.

Ont., Guelph—Guelph Stove Co. awarded contract for addition to foundry. Estimated cost $250,000.

Ont., Oshawa—Skinner Co. Ltd., Gananoque, plans the construction of a 100 x 400 ft. factory for the manufacture of automobile bumpers. Estimated cost $200,000. Architect and engineer not selected.

Ont., Toronto — Canadian Pacific Ry. Co., Montreal, Que., awarded contract for the construction of a group of coach yard buildings on York St. here. J. M. R. Fairbairn, Montreal, Ch. Engr.

Ont., Toronto—James Morrisson Brass Mfg. Co., 9 Adelaide St. W., plans a 4 story addition to factory. Estimated cost $160,000. Private plans.

Ont., Windsor—Swedish Crucible Steel Co., 1165 McDougall Ave., awarded contract for a 1 story factory on Hanna Ave. Estimated cost $100,000.

Que., Berthierville—Berthierville Automobile Ltd., plans the construction of a garage, service station, etc. Estimated cost $49,000.

Que., Longueric—Fairchild Airplane Mfg. Co., Farmingdale, N. Y., plans the construction of a plant here.